Electrical World

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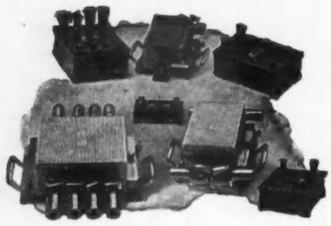

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Electrical World

New York, Saturday, October 29, 1921

How Long, O Lord! How Long?

BEFORE the people of the United States today there stand some of the most serious, complex and pressing problems that any nation has ever faced. They call for honest analysis, for balanced judgment, for positive decision, for constructive legislation and for prompt action. In Washington are ninety-six senators and four hundred and thirty-five representatives, each one selected, empowered and paid to do this job—and Congress talks and talks and talks.

The country is burdened with an unjust system of taxation that is hard to pay. People are sick of it. They know that a different arrangement—preferably the sales tax—will produce the needed revenue and yet make taxes easier. The administration has promised it. The country waits. But Congress talks and talks.

The old economic relationships between America and Europe are turned topsy-turvy. Our export trade has gone to pieces. The tariff must be readjusted. Business needs it. The administration has promised it. The country waits. And Congress talks.

The railway systems of the country cannot pay the dividends their stockholders are entitled to. They cannot even maintain their equipment and replacements. They are powerless to better these conditions until they receive a settlement from the government. This settlement will loosen a flood of railway orders that will bring tremendous stimulus to business everywhere. The administration has promised it. The country waits. But Congress talks and talks.

America has a huge fleet of merchant ships. A few are profitable. Many are running at a loss. Hundreds upon hundreds are tied up idle. They cannot operate under our existing shipping laws in competition with foreign flags. The administration has promised to right the situation. The country waits. And Congress talks and talks and talks.

How long, O Lord! how long?

America today is pleased with its administration. President Harding and his well-chosen cabinet have the confidence of the country. These men are doing their utmost to work out these and our other problems, to support our industries and to restore good times—while in Congress this one orates about the glory of the Republican (or Democratic) party and that one declaims about the perfidy of the honorable gentlemen on the other side.

The ELECTRICAL WORLD believes that the situation has reached a stage where it has become the duty of business executives and individuals to call upon their senators and representatives in Congress by letter, by wire and in person, and ask them flatly: "What have you done or even said to hurry through the work we pay you for?"

James Remsen Strong

President of the National Association of Electrical Contractors, now serving his fourth term, to whom the industry is indebted for far-sighted guidance in association organization and governance.

SIXTY years ago Friday of this week James R. Strong was born in the city of New York. He stands today among that small group who have made their earnest work the development and organization of the electrical contractors of the country, and along these lines he has done much for the industry. Mr. Strong has a peculiar genius for association organization and the framing of the machinery of constitutions and by-laws. He has made his hobby the study of effective measures for advancing the interests of the electrical contractor-dealer through associated work, and his foresight in discerning not alone the functions and the opportunities of such a body but the limitations of safety in its activities has been a guiding influence through the years.

Mr. Strong was a charter member of the National Association of Electrical Contractors and has been four times elected its presiding officer. It is primarily to him that the association owes its constitution and the molding of its plans to meet the changing times. With Earnest McCleary, Mr. Strong has served on the constitution committee for many years, and in 1917, when it was decided to broaden the scope of the organization to include all retailers of electrical merchandise, this committee carried through the problem in a way that was truly constructive.

The work which Mr. Strong has done for the electrical industry has not been spectacular, but it has been fundamental. His temperament leads him to apply himself quietly, modestly and without ostentation, but he is a constant worker, absolutely dependable and everlastingly on the job. There are few men in the industry who have so consistently applied themselves to the service and advancement of the electrical community, with whole-hearted devotion, the sacrifice of personal time and interest and the actual achievement of beneficent results of permanent value. He has almost unlimited capacity to accept responsibility and broadly carry on the association work which for so many years has flowed to him. Because of what he has done Mr. Strong has won the confidence and affection of the electrical contractors of the country to a remarkable degree. His keen sense of fairness, his clear-thinking impartiality, his good business judgment, his ability as an executive and administrator, and above all, his readiness to face facts and conditions as they are, have made him a natural source of strength and guidance through the rapid evolution of the field of his chosen work. Mr. Strong has been prodigal in his gift of time and effort to the electrical contractors of America. He has devoted himself also to the work of the church and furtherance of many charities and campaigns for civic betterment with equal zeal.

James R. Strong was born in New York, Oct. 28, 1861, and was graduated from Trinity College, Hartford, Conn., in 1882. For four years he was employed by the Watt-Campbell Corliss Engine Works and the United States Electric Lighting Company in Newark, N. J. He was next superintendent of the construction department of the United States Illuminating Company in New York. Since 1890 he has been president of the Tucker Electrical Construction Company. He served as president of the National Association of Electrical Contractors and Dealers from 1905 until 1908 and is once more serving as president this year.

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The Evolution of the Private Dwelling

THE housing situation, trying as it is, is not without its bright side to electric public utilities, particularly in the larger cities of the country. These cities abound with solidly built-up private dwellings block after block. Because of the inability to obtain servants, and for other reasons, these houses are being converted into small apartments or flats, so that where formerly but one family was supplied with electricity, there are now many. Moreover, the type of apartment evolved is particularly adapted to the use of electricity. Most of them are not equipped for housekeeping, and in preparing breakfast and light lunches wide use is made of electrical cooking devices. Thus the electrical load per house has increased from fourfold to tenfold and the income from it proportionately. Inasmuch as this business does not call for additional outlay on the part of the utility, it is particularly attractive and welcome. It makes for greater use of investment and should be sought and encouraged.

The Crumbling of the Railroad Strike

TRULY the people rule in the United States when they assert themselves. The railroad workers called a general strike intended to throw countless millions out of work, despite the unemployment situation, and to paralyze the business of the country at a time when it can least withstand the blow, because they do not want their wages cut in line with general deflation. The American people, hearing what they had to say, decided that if regulation is fair for the railroad companies, it must be no less fair for the brotherhoods and expressed this judgment calmly and flatly through the press. So, at the time of writing, eight unions, numbering one-half of the two million men ordered to strike, have announced that they will not go out. The brotherhoods and telegraphers stand alone, shorn of support and sympathy, and are apparently looking for a way to save their face. The strike is clearly crumbling.

It is a most unfortunate thing that all this should have happened. For the sympathy of the public naturally flows to the laboring man, and the brotherhoods have sacrificed a precious thing in forcing the public to decide against them on an issue so ill considered. If the Interstate Commerce Commission and the Federal Labor Board are to guide and regulate the railroads and workers and are to act in harmony and serve the interests of the country, they must make such decisions and issue such orders as their best judgment shall direct—and the railroads and the workers must obey them. Neither side can refuse to obey on the ground that the other government regulating body has not taken the same action with the other side at the same time. As prices and costs come down and the dollar creeps back toward its old-time value the brotherhoods must accept still lower wages and the railroads must accept still lower rates as lowered cost of living makes it right, and both must trust the fairness of the public to see that an even balance is maintained between them. The railway workers are apparently about to comply. Now we must have lower freight rates. For on lower freight rates hinge lower costs of food and cheaper building materials. Public opinion is demanding all this with no less conviction than it has demanded lower wages.

Maintaining Service Ideals Through Interconnection

DEMONSTRATIONS of the importance of continuity of electric service are becoming more and more frequent as demand for service continues to exceed station capacity in fast-growing sections. By utilities and customers alike the fundamental soundness of interconnection of adjacent transmission systems is being realized. This is especially true where advantage can be taken of diversity of load and the existence of different watersheds. The tying in this week of the transmission system of the Alabama Power Company with the transmission systems of Georgia and North and South Carolina is a case in point, for it has brought relief to the customers of the Carolina Light & Power Company, which, owing to low water, has been short of power for some time. In this case the surplus energy literally passes through the hands of four organizations and represents a co-operation of which the customers benefited should know the extent and the true meaning. To render this service over something like a thousand miles of high-tension lines changes are necessary, together with certain inconveniences to normal service on each system which cannot be evaluated in dollars and cents. The service is rendered on the basis of a co-operation in which all concerned may need to partake at some other time, and therefore, after all, it will reap its reward by protecting the ideal of continuous service to small and large customers alike, wherever situated. This ideal all central-station companies guard as one of their greatest assets and at all times try to protect.

An Interesting Rural-Service Contract

THE latest move in the rural-line situation comes from Iowa in the form of a service contract that is designed to place the responsibility for the construction and maintenance of the lines on the consumer and yet give the utility the necessary supervision and responsibility to insure proper construction and maintenance and avoid future difficulties similar to those encountered in the rural telephone field. A discussion of the contract by W. J. Greene of the Iowa Railway & Light Company is printed elsewhere in this issue.

In the features mentioned the application of the contract will produce virtually the same results that have been realized under other well-thought-out plans for providing the service. The success of the plan is largely dependent on the ability of the company to get the farmer to approve it and to hold him in line year after year.

The form of rate is the most interesting part of the contract. Owing to the nature of the agreement the items of construction, fixed charges and maintenance do not enter into the rate but are paid independently. The rate, therefore, becomes uniform for the entire territory and, except for the coal clause, is independent of the rates in the adjoining communities. Furthermore, it concentrates all the service and capacity charges in a fixed charge for which the farmer understands that he is getting no electricity. Except for a small amount of energy, the consumer gets a very low rate that encourages him to use the service in the largest possible way. The rate form as expressed is rather awkward and may be difficult to explain to the farmer. This, however, is a matter that could be easily remedied if found necesary. It is one of the first consistent attempts that have been made to get away from the older forms and put into practice a theory of rates for the encouragement of rural business that a great many have discussed but not yet had the courage to try. The effort will not only be watched with interest but merits close study.

Higher Standards in Street Lighting

IN THE current issue of the ELECTRICAL WORLD W. D. Jennings gives an account of the new street-lighting system at Stamford, Conn. This is not a case of replacement of an old and bad system, but of the improvement of a thoroughly good system by better fixtures, better distributed, and the addition of a large amount of useful light. The lighting was good, but there was not enough of it, and the city in making a new contract wisely undertook to do the work more thoroughly. To this end 150 6.6-amp. magnetite lamps were installed in ornamental paneled globes mounted on well-designed posts on each side of the streets to be lighted. The spacing on each side is at about 100 feet, and the posts are staggered as respects the two sides of the street. At this spacing and with these powerful lights comment on the quality of the illumination is needless. Eighty lamps of the earlier plant were retained for the outer zone of the new arc-lighted area. Incidentally the 60-cp. vacuum incandescent lamps formerly employed there were changed to 100-cp. gas-filled lamps, which of itself was a decided improvement.

The especially interesting features of the new arc system lie in the methods of supply and the methods of control. The lamps are operated on two independent circuits, one for each side of the street, so that after midnight one circuit can be cut out and the streets still be left well lighted for the needs of the late hours. As regards the method of feeding, the general supply is through banded steel-armored cable. This cable was laid in narrow trenches just on the street side of the curb. These trenches were excavated by machinery, the cable was laid in and covered with wood strips, and then the trenches were filled in with concrete flush with the street surface of vitrified brick. In this way the entire new service was inaugurated without any serious tearing up of the streets, and it is believed that the system will stand up well in continuous use. The whole equipment is thoroughly modern and efficient as respects the type of lighting, one toward which up-to-date cities are steadily moving.

Insulation of Machinery a Constant Problem

STANDARD forms of machines have now been with us for so long that we have unconsciously come to regard them as being inherently reliable. This confidence is apt to cause one to overlook the constant vigilance and effort necessary on the part of the manufacturer in guarding and improving insulation. Insulation is the Achilles heel, the almost invariable point of failure of electrical machinery. It is an irony of nature's laws that insulation, necessarily composed of the most delicate and perishable materials, should usually be that part of the electric structure which is subjected to the severest mechanical treatment. Particularly is this the case in rotating machinery.

From the very beginning of construction insulating materials are subjected to treatment tending to destroy their properties. First they must be applied closely to coils of the most varied shapes, having short turns and sharp edges. Then the coil itself after being insulated must usually be bent in placing it on the armature or field of the machine, and finally it is either driven or wedged into its proper location, which generally results in jamming or scraping across the sharp edges of laminations. Then when put into operation the vibration due to rotation, together with the air clearances between windings and metal, creates the worst possible condition for the preservation of the qualities of insulation. If one looks still further at machinery subjected to worse conditions than normal, as, for example, machines in steel mills and industries in which abrupt changes of load occur and machines which operate under abnormal temperature conditions, it is seen at once that the demands upon the mechanical structure of the insulation are severe indeed. The wonder is that it is possible to construct machinery which will stand up and live under the conditions imposed upon the insulation. The success that has been reached is due to elaborate study and experiment, both in the selection of materials and the design of the insulating structure, and to the utmost care in methods of assembly.

The two most serious dangers being the actual destruction of the material under excessive temperature and mechanical breakage due to vibration, it is interesting to note the two broad lines of defense which have been adopted. Obviously, as regards temperature, those materials which possess the flexibility requisite for assembly are not able to withstand high temperatures. This fact has resulted in the limiting figure of temperature permitted by the Standardization rules of the American Institute of Electrical Engineers for machines in which this character of insulation is used. Mica is about the only substance which possesses high insulating power together with temperature-proof qualities. Consequently, although its mechanical properties are not ideal for assembly on complex shapes of coil, it is nevertheless relied upon almost exclusively for the insulation of those machines which must operate under extreme temperature conditions.

As regards the dangers from vibration and distortion

of insulation under the action of the rotation of the machine, the significant fact in the attack of this difficulty is the effort to insure as nearly as possible absolute unity and rigidity of structure between the insulated windings and the frame of the machine. A close fit of the coil in the slot, rigid bracing of the ends of the coils, and often a thorough saturation of the exposed parts of the winding with a compound solidifying to a stiff body, are the usual methods adopted in this particular. It is worth noting that there is considerable evidence that if a rotor with assembled winding is submitted as a whole to the modern processes of drying and impregnation, the life of its winding can be greatly increased. The objection to this method of treatment is probably that it adds to the difficulty of repair. It therefore seems probable that if this method cannot be followed, manufacturers must for the present at least continue to retain some of their best engineering talent and the most constant vigilance in the shop on the problem of shutting out the possibility of mechanical movement of the assembled winding.

Fair Return on Value of Property Used and Useful in Public Service

THROUGHOUT the sessions of the annual meeting of the National Association of Railway and Utilities Commissioners in Atlanta, Ga., unanimous approval, either spoken or implied, of the frankness, broad vision and fair spirit displayed by Commissioner Perry of Georgia in his presidential address was manifest. He said, for instance:

"Dating from two years ago, there is no doubt that many commissioners throughout the country made the common mistake of holding light, power, gas and street-railway companies to rates that were too low, hoping that the immediate future would justify the rates prescribed, but this hoped-for condition was not realized."

This utterance will not only be welcome to many utilities that are facing agitation for rate reductions, but it will serve as a fundamental principle that can well be put forward in rate discussions for some time to come; for if there shall be any reduction, it must come with sufficient slowness to protect the quality of electric service and offer no hindrance to its expansion at a rate in keeping with the business needs of the communities served.

Another interesting point touched upon by Mr. Perry in his address, which appears elsewhere in this issue, has to do with capitalization in rate making. Although it has been possible to show that no overcapitalization now exists in utility financing, it is refreshing to have a confirmation of this fact from so high an authority as the National Association of Utility Commissioners. The assertion that "A fair return on the value of property used and useful in public service and just compensation for the use of property owned by utilities is a constitutional right which cannot be denied" will bear frequent repetition in this particular form as embodying a fundamental element of simple, adequate service to the public. With commissioners everywhere accepting it and following Commissioner Perry's suggestion that regulatory bodies shall forthwith publish the truth when newspapers attack utilities and publish untruthful statements concerning their earnings, the day will soon arrive when the utilities will be free from suspicion and a welcome factor in the business plans and community development programs.

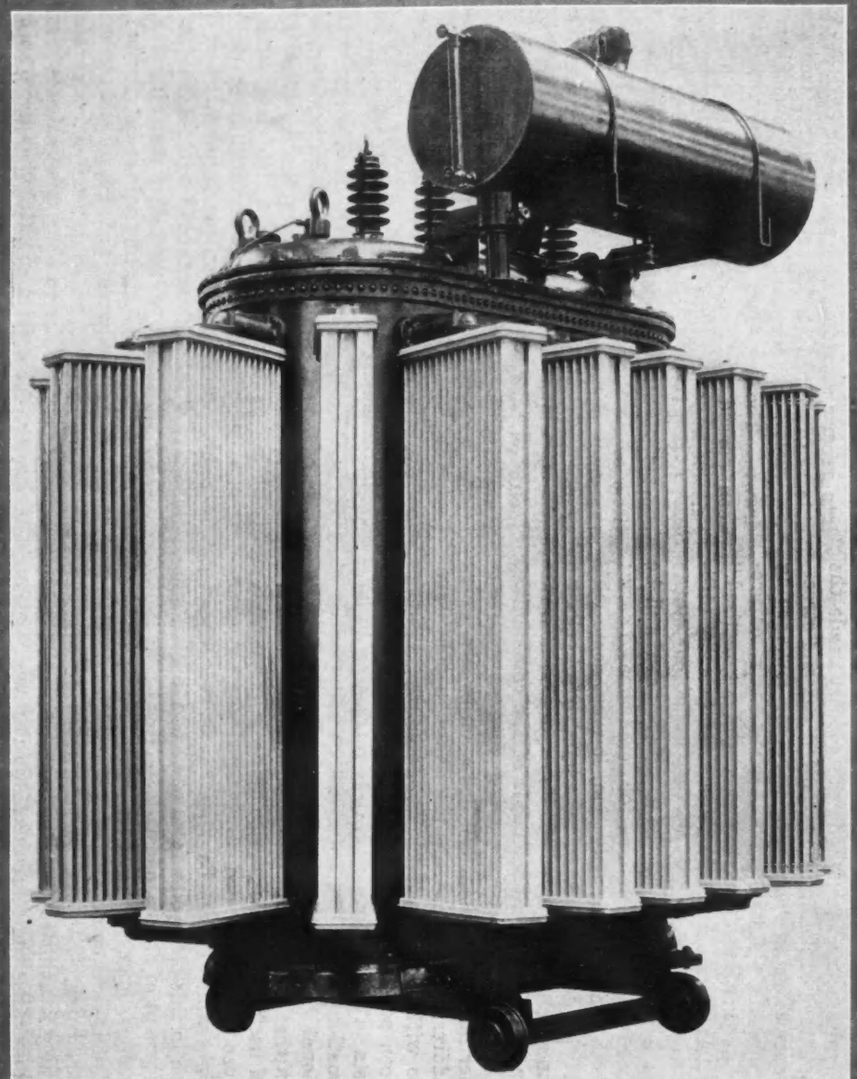
Fundamentals in Studies of Power Factor

THE power-factor problem is fundamentally an economic and not an engineering one. Although the final answer must take an engineering form, the real question is the increase in cost that a decrease in power factor makes in the service rendered a consumer. At the present time power-factor discussions are clouded by a lack of agreement as to the results that must be obtained in the measurements taken as a basis for billing. The kilovolt-ampere demand, kilovolt-ampere-hour, a combination of the two and various combinations of these with the present accepted energy units have been proposed. The confusion arises largely from a lack of sufficient data on which to base conclusions, since the plant with its peak load during the lighting hours of the day presents a different problem from the plant with a peak load caused during the daytime by an industrial power load. The consumer's maximum kilovolt-ampere demand may come during the maximum-load hours or it may not. Even if it comes during the off-peak hours, it may have characteristics that are embarrassing from the standpoint of other classes of service. Although the off-peak kilovolt-ampere demand may not affect the power-house investment required to serve the consumer, it may seriously affect the distribution or transmission system investment, which may be roughly estimated at half total average investment cost.

The greatest practical hindrance so far in obtaining adequate data has been the lack of meters that are really practical for general use. The various methods or combinations that have been used involve so much complication that the operator has hesitated to put them into general service. As a result the data so far available are confined to the so-called large consumers and are yet so meager that no broad conclusions can be drawn. The big class of small power consumers has been barred from consideration by the utter lack of suitable meter equipment together with other difficulties that have so far seemed insurmountable, and the relation of the lighting consumer to the problem has had little or no thought. The big need of the moment in the study is for data from widely scattered sources and from thousands of consumers of all classes that will provide a basis for determining the effect of power factor on both the power-house and the distribution or transmission-line investment. In this study central-station engineers and manufacturers must co-operate.

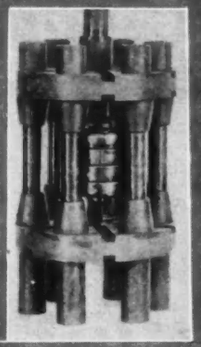
Good Records a Step Toward Economy

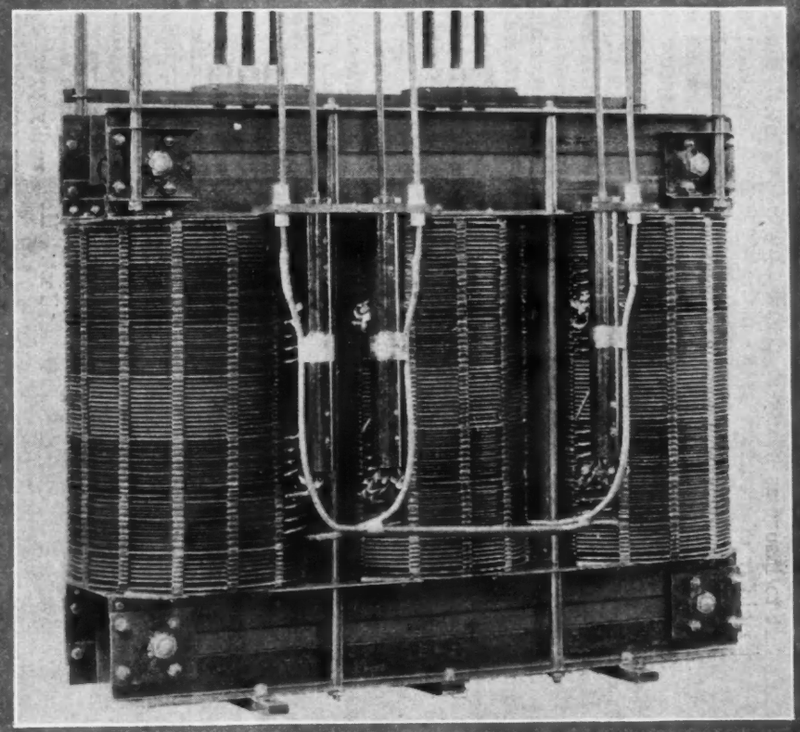
A GOOD set of records on transformer ratings and loads carried is an excellent basis on which to apply economical methods in the handling of a distribution system. If kept up to date, such records should pay for themselves in facilitating the planning of new construction and addition of new services. However, it should not be forgotten that the adoption of an effective record system is only a step in the economical handling of a distribution system. Thorough groundwork and costs and determination of annual charges on equipment and accurate calculation of energy losses can produce the result that is wanted. A correct practice, based on such studies, is made possible of application by the possession of records that will indicate what is happening on the system and give a basis for planning improvement.



10,000-Kva. Self-Cooled Transformer

THROUGH the use of radiators, oil conservators and externally operated ratio adjusters, transformer manufacturers have overcome some design and operating difficulties of long duration. At the left is a 10,000-kva. self-cooled transformer, which is good evidence that there are virtually no limitations to the size in which such units can be built and transported. The conservator, which maintains a static head on the oil in the tank, prevents the accumulation of combustible gas and also the sludging caused by contact of the hot oil with air. Where the necessity of taps on large high-voltage transformers outweighs their objections the externally operated ratio adjusters, shown installed on the transformer below and in detail above, will eliminate the inconvenience of opening transformers and drawing down the oil to change connections.





Steel-Clad Rectifier Merits Attention

In Europe They Have Been Developed for Outputs Up to 900 Amp. at 800 Volts—With Slight Changes They May Be Adapted to 2,500 Volts—Efficiencies and Power Factor Are Very Attractive

By J. H. MILLIKEN
Midstates Engineering Company, Chicago, Ill.

WITH a record of 100,000 kw. of installed capacity in Europe, the large power rectifier has reached a point where it merits consideration in American practice. The war period interfered with the usual international intercourse, and the introduction of other problems has also played its part in delaying consideration of the introduction of apparatus under new conditions and the experimental work necessary thereto. The development work in Europe has been carried on and the apparatus brought to its present state of operating efficiency by Brown, Boveri & Company of Baden, Switzerland. A description of European practice on which this article is based may be of interest to any American engineers who wish to consider its use in this country.

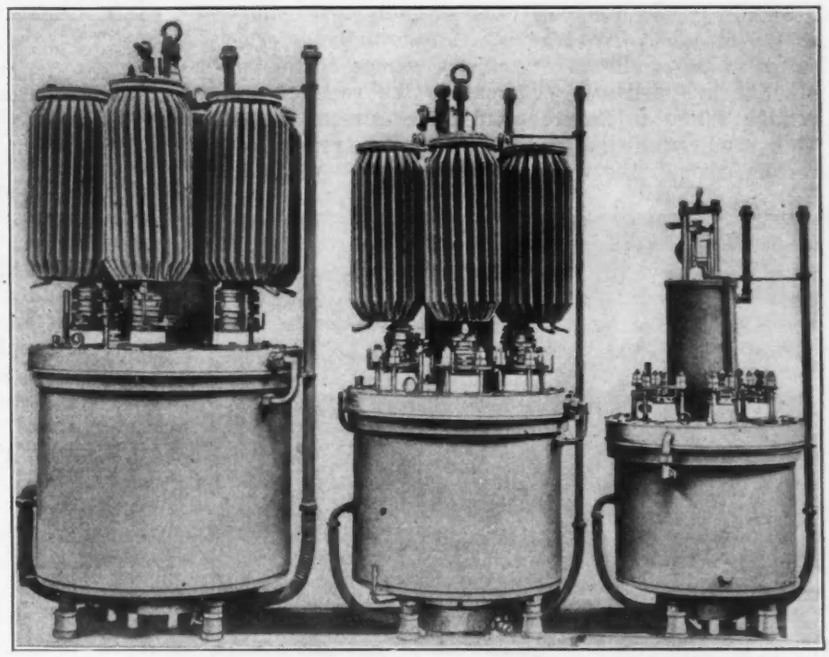


FIG. 1—THREE STANDARD UNITS DESIGNED FOR DIRECT-CURRENT OUTPUT OF 300, 600 AND 900 AMP. AT ANY VOLTAGE UP TO 800. WITH SLIGHT CHANGES RECTIFIERS MAY BE EASILY ADAPTED TO HIGHER VOLTAGES UP TO 2,500

The negative electrode resistance phenomenon of the electric arc in mercury vapor, permitting current rectification, is thoroughly familiar, as are the various adaptations of this arc in single-phase rectifiers for battery charging, operating arc lamps, etc., and will not need discussion.

In constructing the large power rectifier the results obtained from the glass-bulb type are of little assistance as the aspect of the problem is entirely changed. One of the principal problems connected with this apparatus, but one which with the bulb type was quite simple, has been to make a tank of sufficient capacity that would be absolutely tight under all conditions. This has been the subject of much experiment by various manufacturers. Without going into detailed description, it is sufficient to say that in the apparatus under the present state of development the problem of sealing has been solved so satisfactorily that the steel tank has actually maintained a vacuum equivalent to a mercury-column measurement of 0.01 mm. to 0.001 mm. over long periods with virtually no operation of the vacuum pump after the first evacuation.

The rectifier consists of an arc chamber or cylinder having a cylindrical extension at the top, both cylinder and extension being built of steel plate. The cover and the base of the cylinder are also made of thick steel plate. The mercury cathode is contained in a dish-shaped recess in the bottom, and the anodes are inserted into the arc chamber through the cover. The cylindrical extension acts as a condenser for the mercury vapor which arises from the cathode, the condensed mercury returning to the cathode to be again vaporized.

The arc chamber is surrounded with a water jacket for circulating cooling water. There is also a water jacket arranged to cool the anode plate and another for the mercury cathode in the bottom of the tank, and these are connected to the circulating system, which is usually arranged as a closed and insulated system using radiators for recooling. Circulation can be arranged on the thermosiphon principle or be actuated by a small pump. When direct-current voltage of less than 600 is used and the system is not grounded clean service water may be used. The anodes through which the current from the transformers is led to the arc are inserted into the cylinder through specially designed insulators and arc guides. The arc guides serve to restrict the play of the arc within a definite area. The anodes on the larger sizes are water-cooled and provided with self-contained radiator and circulating system. The vacuum in the cylinder is established after installation and maintained as occasion may require by a small vacuum-pump unit which accompanies each station equipment. The cylinder unit is insulated and supported on a suitable base, as is also the vacuum-pump outfit. The entire equipment is in all cases totally inclosed in a protecting guard.

The arc operates in the arc chamber between the main anodes, of which there are six when six-phase connection is used, and the cathode or body of mercury in the bottom. The arc is started by an auxiliary

ignition anode which automatically makes contact with the mercury cathode when the circuit through a solenoid operating this anode is energized. In making contact with the mercury the solenoid coil is short-circuited, which allows the separation of the ignition anode from the mercury by spring action and starts an arc at that point. This small arc at any time vaporizes sufficient mercury to establish the main arc. A small auxiliary arc fed from a single-phase exciting transformer connection through a choke coil and resistance stabilizes the arc when load is widely fluctuating or drops to zero.

Supplying each rectifier bank or individual cylinder as the case may be there is a stepdown transformer suited to the conditions of primary voltage on the supply line and delivering current to the rectifier at a voltage suited to the required direct-current output. This requirement is similar to that of rotary convertors, though the ratio of secondary voltage to the

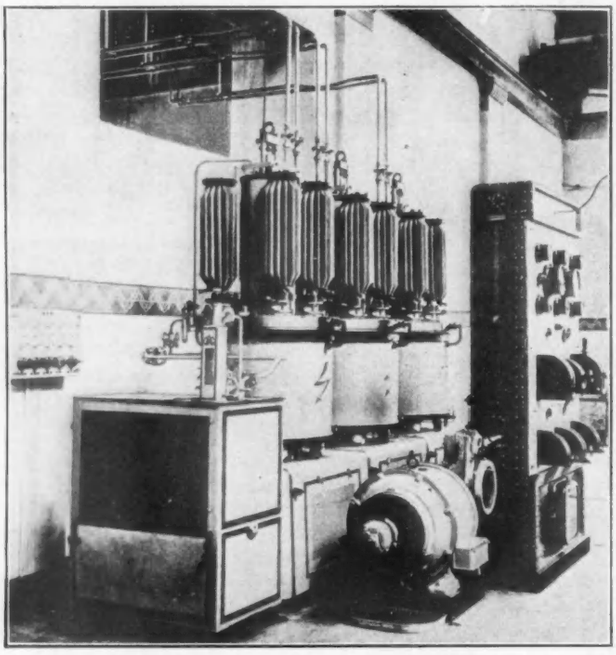


FIG. 2—INSTALLATION OF THREE 600-AMP. UNITS, SHOWING COMPACT LAYOUT POSSIBLE WITH THIS TYPE OF APPARATUS

direct-current voltage differs from that of either the three-ring or the six-ring convertor.

The rectifier economizes floor space as the cylinder unit need not be accessible for operating attention, all operating being done from the switchboard. The cylinder unit is not heavy and has no moving parts, so foundations are not required and it may be placed on galleries or on floors in buildings not especially designed for substations. If erected in the center of the room, ducts or conduit for cable or bus must be provided in or below the floor slab.

The simplicity and ruggedness suit it especially to automatic and portable substation uses. The attendants in a non-automatic substation need have no more skill than would be demanded for a transforming station, as the operating functions are no more involved than switching. Standard single units in production and use:

Type	Amperage	For Voltages Up to
G 3/16	300	800
G 4/6	600	800
G 5/6	900	800
HG 3/6	300	1,200

The units work perfectly when banked in parallel, anode reactance coils being used if they are fed from a common transformer. They can be worked also in parallel with any type of direct-current apparatus such

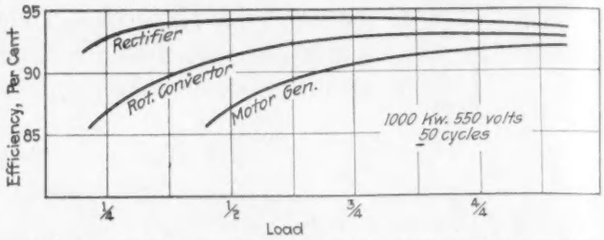


FIG. 3—COMPARISON OF EFFICIENCY OF STEEL-CLAD RECTIFIER, ROTARY CONVERTOR AND MOTOR-GENERATOR OVER LOAD RANGE

as rotary convertors, motor-generators or storage batteries. The parallel operation in bank with proper distribution of load is fixed so that no adjustment of voltage is necessary when putting on or taking off units. Compounding is provided as required to take care of voltage change to meet changing load. Adjustable output voltage through a wide range is possible by the imposition of an induction regulator upon the alternating-current supply.

A most pronounced advantage of the rectifier, particularly for peak, mill and railway work, is its remarkable overload capacity. Short-time overload capacities:

Duration of Overload, Minutes	Per Cent of Normal Rating Permissible
2	300
5	200
10	150
30	125

There is no flashing over or damage to the rectifier from external short circuits. Momentary short circuits do not affect the apparatus at all, and severe ones are, of course, cleared by the usual protecting breaker.

The characteristics of the units evidence high power factor over all, very high unit and over-all efficiency at all loads, and excellent regulation with compounding where required. The power factor averages around 95 per cent, and the efficiency at full load varies from 92 to 98 per cent, depending on the direct-current output voltage utilized.

The efficiency of a cell itself does not change with the load current, but in taking account of complete plant, transformer and auxiliaries must be included.

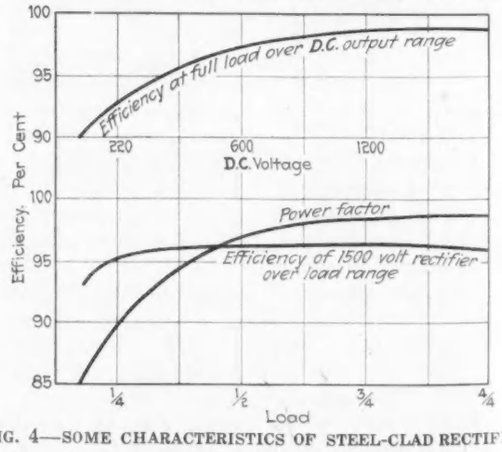


FIG. 4—SOME CHARACTERISTICS OF STEEL-CLAD RECTIFIER

From the accompanying curves it will be seen that the efficiency remains virtually steady down to one-quarter load, when these fixed losses have a marked lowering influence on the curve. It may also be seen that the rec-

tifier has considerable advantage over the rotary at less than full load and somewhat better efficiency at full load. The very high and almost flat efficiency curve of a rectifier supplying 1,500 volts direct current is shown in one of the curves.

The records of a number of stations that have been in service for a sufficient length of time for observation indicate that the apparatus gives reliable performance with very small maintenance cost. The performance of a substation supplying heavy steel-mill service is of particular interest, this being one of the earliest installations. This station was put into service six years ago and has been attended solely by women operators since that time. The station was recently shut down for inspection and all units were opened. No evidence of deterioration was found.

A New Form of Rural Service Contract

Iowa Company Employs Contract Under Which Consumers Furnish Line and Company Assumes Responsibility for Maintenance—Unusual Form of Rate with Low Energy Charges

By W. J. GREENE
Iowa Railway & Light Company, Cedar Rapids, Iowa

A NEW form of rural service contract that reaches the same general results as do the rules in several states where the farmer is required to advance the money for construction purposes and deed the line to the central-station company is being put into use on the properties of the Iowa Railway & Light Company, with headquarters in Cedar Rapids, Iowa. The principal features of the contract are as follows:

1. The farmer constructs the line in accordance with specifications furnished by the central-station company. The company may refuse to connect if the line in its judgment is not in accord with the specifications. Ownership remains with the farmer.

2. The central-station company takes charge of the maintenance of the line under the contract and bills the consumers for the expense. In making the rate no depreciation charge is included as it is expected that maintenance will keep the line at a point where the cost of reconstruction will be spread over a long enough period to avoid excessive charges at any one time.

3. The rate carries a service and capacity charge which varies with the demand and transformer capacities respectively of the individual consumers. The energy rates consist of a high primary-base rate that is designed to cover the capacity charges for the first kilowatt of load and an unusually low excess-energy rate. The rate is designed to put all the consumer and excess demand charges in a monthly fixed charge and prevent the attitude of mind that the consumer usually takes with the minimum-charge form of rate. Under the form of rate used, the cost of energy used for other purposes than lighting comes at a very little increased cost, thus encouraging the farmer to use the service he has already paid for freely. The schedule includes a coal clause on which the energy rates will be adjusted as the cost of coal fluctuates.

Following is the contract form and rate used for the individual consumers. At the end of this is also given the rate for service to a rural corporation. It is taken from a contract which is similar in form and requirements to the one for the individual consumer.

INDIVIDUAL RURAL ELECTRIC SERVICE CONTRACT

Memorandum of agreement made in multiple this —— day of ——, A. D. 192 , by and between the Iowa Railway & Light Co., an Iowa corporation, hereinafter called the "producer," and the undersigned individuals, hereinafter called the "consumers":

Witnesseth: That for and in consideration of the agreements of the parties hereto, hereinafter set forth, and the performance of said agreements, it is mutually understood and agreed by and between said parties as follows:

1. The consumers shall provide a —— volt, —— phase, —— cycle rural distribution system constructed in accordance with specifications furnished by the Board of Railroad Commissioners of the State of Iowa or other legally authorized body, or in the event specifications have not been provided by any such legally authorized body, in accordance with specifications furnished by the producer. Said distribution shall begin at —— and end at the meters on the consumers' premises. The consumers shall furnish the producer with an accurate map of the said distribution system and all extensions made thereto. Said distribution system shall be known as the —— line. If, in the judgment of the producer, the construction of said distribution system is not in accordance with the specifications, the producer may refuse to make connection with said distribution system until the construction complies with the specifications or the producer has been ordered to make connection by the said Railroad Commission or other legally authorized body.

2. The producer shall maintain and operate the said rural distribution system, and the consumers shall pay the producer for the service of said maintenance and operation the schedule of charges filed in the office of the manager of the division in which the consumers are located. The charges for said maintenance and operation shall be apportioned equally among the consumers, unless otherwise authorized by a written notice signed by all the consumers. Each consumer shall make payment for the service of maintenance and operation within ten days after rendition of a bill therefor.

3. The producer shall, except during construction, protect, defend and indemnify the consumers against any and all claims for damages growing out of the maintenance, operation and ownership of said distribution system, provided the consumers give by telephone immediate notice of all accidents to the division office of the producer followed by personal or written notice with fullest information obtainable. All claims for said damages shall be forwarded immediately to the office of the general manager of the producer at Cedar Rapids, Iowa. The consumers shall forward to the producer every summons or other process served upon them in any suit, however groundless, on account of any claim. The consumers shall, except in a pecuniary way, render to the producer all reasonable co-operation and assistance in the protection of the producer of its or the consumers' interests. Each consumer shall pay for said protection the sum of $—— in advance for the first year of this agreement and annually in advance thereafter the sum necessary for said protection.

4. The producer shall use due diligence and exert every reasonable effort to provide uninterrupted service, but shall not be liable for damages resulting from interruptions of service.

5. The producer shall furnish electric service, and the consumer shall use and pay for such service in accordance with the terms and conditions of this agreement and the rules, regulations and charges of the producer. The rules, regulations and charges effective at the date of this contract are given in Exhibit A, attached hereto and made a part thereof.

6. The undersigned consumers shall form an electric farm line corporation or association upon written notice from the producer whenever there are more than ten individuals who will contract for service from the said distribution system or any extension thereof. This agreement will be terminated on the date the agreement between the producer and such electric farm-line corporation or association becomes effective.

7. The failure of either of the parties hereto to enforce from time to time the strict performance of any of the covenants and agreements herein contained, or the waiving from time to time of a default on the part of either of the parties hereto shall not be construed as a waiver of any containing or subsequent default or defaults nor impair the right of either of the parties hereto subsequently to require the strict performance of each and every covenant, agreement and undertaking herein contained.

8. The consumers shall give or secure permission for the producer to do the necessary pruning of trees along the right-of-way of the rural distribution system and to do other things essential to the efficient and safe operation of the said rural distribution system.

9. Each consumer shall obligate a grantee or lessee of the premises of the consumer to become a party of this agreement as a consumer.

10. Wherever the word consumer is used in this agreement, it shall mean each signer hereto as a consumer and such others as may become consumers by the execution of a proper form of rider to be attached hereto or by a supplemental agreement.

11. The rules, regulations and charges of the producer affecting the consumers may be revised by mutual consent of both parties. In the event that either part shall, by written notice, request a revision of said rules, regulations and charges, and such revision shall not have been effected by mutual agreement within sixty days after the date of said written notice, either party may submit the matter to any legally authorized body as provided in Article 12, or in the absence of such body, either party may bring an action in equity in any court having proper jurisdiction.

12. The foregoing terms and conditions of this agreement and the rules, regulations and charges of the producer shall be subject to revision by any legally authorized body which may be given jurisdiction thereover by the State of Iowa.

INDIVIDUAL SERVICE RATE

A PRIMARY BASE RATE of 10 cents per kilowatt-hour for the first 30 kilowatt-hours used per month, plus

AN EXCESS BASE RATE of 3 cents per kilowatt-hour for all electricity used in excess of the first 30 kilowatt-hours used per month, plus

A MONTHLY SERVICE CHARGE of $1 per consumer, plus 12 cents for each tenth of a kilowatt of demand in excess of 1 kw., plus the amount shown below opposite the size of transformer used by the consumer. When two or more consumers use a transformer in common the said amount will be apportioned among them by the ratio that the demand of each bears to the sum of the demands.

Size of Transformer Kva.	Amount	Size of Transformer Kva.	Amount
1	$0.45	7½	$1.50
1½	.60	10	1.90
2	.75	15	2.50
3	.90	20	3.10
5	1.10	25	3.75

The primary and excess base rates will be increased or decreased beginning with January 1 and July 1 of each year for the next six months' period at the rate of 1 mill per kilowatt-hour for each 30 cents or major portion thereof variation above or below $5.50 per ton for the cost of coal burned in the previous six months' period. The cost of coal burned to include all the costs that are chargeable to the accounts of fuel, boiler-room labor and water for power at the —— power plant.

The demand of a consumer will be determined by the manufacturer's rating of the consumer's largest electricity-consuming device or by measurement at the option of the company. Minimum demand, 1 kw. (Note: One motor horsepower will be taken as the equivalent of one kilowatt.)

No consumer shall install, without notifying the producer, any device that has a larger kilowatt rating than that indicated opposite his name in the following table:

[A form is provided here for the listing of consumers contracting for service.—EDITOR.]

RULES AND REGULATIONS

1. *Metering Equipment.*—The producer will furnish, install and maintain the metering equipment, but the consumer shall provide a suitable place for such equipment in accordance with the specifications of the producer.

2. *Installation and Maintenance.*—All wiring, equipment and apparatus must be installed and maintained in accordance with the legally authorized code.

3. *Protection of Service.*—Consumers shall not use the producer's service for operating wireless equipment or other equipment that will affect the service of the producer, without complying with the producer's rules governing such equipment.

4. *Testing and Removal of Meters.*—Consumers shall allow the producer's agents to enter the consumer's premises at reasonable times to read, test or remove the meters.

5. *Meter Loop.*—Consumers shall furnish and install the meter loop and cutout in accordance with the specifications of the producer.

6. *Charges for Installation and Removal of Meters.*—The first installation of a meter for a consumer is covered in the service charge, but a charge of $1.50 will be made for each subsequent installation for the same consumer.

7. *Correcting Meter Errors.* — In case a meter is found to be incorrect by more than 2 per cent plus or minus, the consumption for the two billing months preceding the test shall be adjusted to conform to the correct amount based on said test.

8. *Stopped Meters.*—Should a meter fail to register during all or part of a month, the bill for the month shall be calculated equitably from the previous or succeeding month or from known load and hours of consumption.

9. *Reading Meters.*—The producer will read meters on or about the same day each calendar month, except in cases where it elects to furnish the consumer with stamped and addressed meter cards, in which case the consumer shall mark the position of the meter dial hands as they exist at such times as the producer may request and mail the card promptly to the producer.

10. *Rendition of Bills.* — The producer will render a bill or bills to the consumer for electricity and such other services as may be due the producer on or about the same day of each calendar month. Rendition of a bill shall be the mailing or delivery of the bills to the address designated by the consumer.

11. *Non-Payment of Bills.*—In the event that a consumer has not paid all of the money due the producer for electric service within ten days after rendition of a bill or bills, the amount due shall be increased by 10 per cent. If said bill or bills plus the 10 per cent increase is not paid within twenty days after rendition, the producer reserves the right to discontinue service until all amounts in arrears are paid in full.

12. *Contnuity of Service.*—The producer will use due diligence to furnish continuous and uninterrupted service, but the producer shall not be liable for damages caused by any interruptions of service.

13. *Applications and Contracts.*—Those desiring service of the producer will be expected to sign a written application where open rate tariffs apply and a contract for all other classes of service.

14. *Deposits.*—Any consumer may be required to deposit $5 or more with the producer. Interest will be allowed on such deposits at the rate of 7 per cent per annum.

CORPORATION RURAL ELECTRIC SERVICE RATE

The following rate schedule is used for service to rural corporations with a similar form of contract:

AN ENERGY BASE RATE of 2.5 cents for all electricity used per month, plus A MONTHLY DEMAND CHARGE of $5 per kilovolt-ampere of demand. plus A MONTHLY SERVICE CHARGE of $——.

The energy base rates will be increased or decreased beginning with Jan. 1 and July 1 of each year for the next six months' period at the rate of 1 mill per kilowatt-hour for each 30 cents or major portion thereof variation above or below $5.50 per ton for the cost of coal burned in the previous six months period. The cost of coal burned to include all the costs that are chargeable to the accounts of fuel, boiler-room labor and water for power at the —— power plant.

The monthly demand shall be the highest average number of kilovolt-amperes recorded in a fifteen-minute period during the month, unless said monthly demand is less than 75 per cent of the highest monthly demand established during the preceding twelve months, in which event the monthly demand shall be 75 per cent of such preceding highest monthly demand.

Appeal for Reason in Utility Regulation

An Encouraging Message for Public Service Companies from the Recent Annual Convention of the National Association of Railway and Utility Commissioners

By JAMES A. PERRY
Member of the Railroad Commission of Georgia and President of the Association

FOR many years there has been a nation-wide agitation looking to the abolition of the rights of the different states to regulate railroads in any manner. The climax of this agitation came with the transportation act of 1920, as construed by the Interstate Commerce Commission. The construction of this act by the Interstate Commerce Commission outlaws state regulation and strikes at the very fundamentals of our system of government. . . .

I have not the slightest doubt that one of the chief financial troubles of the carriers of the country today is the fact that rates, both freight and passenger, are so high as to result in an aggregate loss rather than a gain as contemplated. High freight rates, especially in cases of short hauls, have done more for the growth of motor transportation of freight than has all the progress of motor transportation itself, which necessarily results in a loss to the railroads. . . .

If the construction of the transportation act of 1920 by the Interstate Commerce Commission is to remain the law of the land, a most hurtful blow has been given our dual system of government—a form of government that has stood the test of time, and chiefly because its form provides for representation of the people, for the people and by the people. The provision that it is by the people is, so far as concerns the regulation of our commerce, partially defeated and the right of local self-government is destroyed in the present construction of the transportation act. . . .

It has always been with the individual states that we have gone forward in the first efforts of any new idea pertaining to our commerce. If proved good in one state, other states can take it up, and finally it becomes national in its scope. Far better that one state try it, should it be unwise, than for our entire country to be subject to an expensive experiment. State regulation of rates meets the demands of local traffic conditions, where an intimate knowledge can be quickly applied, whereas at one common center the truth in most cases will never be known. Remove, if you will, the state lines and you still have the problem of reasonable local rates, and to be fixed by one central body that can never have more than a smattering idea of the real local conditions. . . .

Rates that are higher than the traffic will bear stop the movement. All over the country, for comparatively short hauls, essential commodities are costing less than the freight to move them to market, with the result that in many intrastate movements motor power is hauling a good percentage of short-haul freight. . . .

Railroad property is as much the property of stockholders who put their money into it as your home and my home is property of ours. And when it is dealt with by any consideration other than that obtaining when the rights of private property are being considered, a wrong is done, first, to the man who has invested his money in the particular railroad; second, to the public, who, in the end, cannot hope to have the service, regardless of rates, if in the meantime the property has been destroyed by prohibitive operating costs and unremunerative rates.

There has been too much misunderstanding between the public and the railroads in this country. I am not unmindful that railroads here and there throughout the country have been guilty of the foolishness of seeking and receiving unnecessary benefits from legislatures now and then—only to serve their purpose for a while, with the result that an outraged people rise up to correct the wrong and, as is often the case, go so far as to do a real injustice to the railroad that ends with a loss to the public and the railroad alike. The railroads of this country can no more carry on their business in this country without the co-operation of the people they serve than they can get along without equipment, and this business of seclusion by centralization of all regulation of service and rates at Washington is going to prove the greatest hurt to the railroads and the commerce of this country that either has ever experienced. . . .

MISTAKE IN HOLDING TO LOW RATES

The question of rates for utility properties has been one of nation-wide concern for several months. Dating from some two years ago, there is no question to my mind that any regulatory commissions throughout the country made the common mistake of holding light and power, gas and street railway companies to rates that were too low, hoping that the immediate future would amply justify the rates prescribed. This hoped-for condition was not realized. The experience was just the opposite of what we had expected to see. The raw materials going into the manufacture of the products sold steadily increased in price. Finally, when business generally became depressed, public utilities had been required to do business on such small returns that they were not in a position to withstand, even for a short while, an increase in actual losses already sustained.

The public at once took the position that public utilities should not expect normal returns, but should endure with other business enterprises slight or no returns at all and, if need be, increased losses.

The law by which regulatory commissions are governed required them to prescribe just and reasonable rates, and the courts throughout the country have declared that a just and reasonable rate is one that with competent management will afford the utility a reasonable return upon the fair value of its property being used in the public service. Just compensation for the use of private property by the public is a constitutional right which cannot be denied. It is the fair value of the physical property devoted to the service that must control, and it does not matter whether it came as a

gift from earnings of years past, actual investment or otherwise. . . .

The public is interested in the utility having such rates as will insure a reasonable return upon the fair value of its property, thus guaranteeing not only an unimpaired service, but such development from time to time as will always be sufficient to meet the requirements of constantly increasing demands for service.

At the present time, in many instances, a utility files an application with the regulatory board of the state in which it operates. This done, a copy of such application is served on the municipality affected by the change proposed. It makes no difference what the relief asked for may be, the mayor and council meet and promptly vote to instruct the city attorney to oppose the granting of the relief sought. No investigation is made as to the justice of the relief petitioned for, the city attorney is directed to oppose it, not to investigate and ascertain the truth, as information for the mayor and council, before action is taken one way or the other.

REGULATED MONOPOLIES ON TRIAL

We seldom hear of a municipality under such circumstances making an investigation and ascertaining if there is any merit in the claim of the utility company. Seldom investigations are made, little information is had, and seemingly none is desired.

This, of course, is an unfortunate situation. In the end it will be overcome, but not without loss to the utility and the public while such a condition prevails. Competitive business had its day and failure. Regulated monopolies are now on trial. The public is still paying 100 per cent more for some merchandise than the same article sold for four or five years ago, but the thought of paying 50 per cent increase in utility rates as compared with prices for such service three and four years ago meets with scant sympathy. . . .

The public is vitally concerned in the expansion of utilities because a city can never grow faster or extend further than her utilities reach. The utilities of a community are the greatest developers any city ever had. No city can build beyond the lines of her street railroads, and this is true to a degree in comparison with the area covered by gas mains.

WILL CAPITAL BE FORTHCOMING?

Few sections of this country can finance utility development of any kind from local capital. The financial necessities of development, therefore, carry us to foreign fields for money. Is there a man anywhere, regardless of his business interest, with surplus money for utility investments, who is going to send his money into communities where there exists a citizenry hostile to foreign capital for such investment? Even worse, will such a man send his money into a state for such investments where the state regulatory board refuses rates that will earn even less than the lawfully prescribed rate of interest as a return for utility service? Will such money find its way into a state where condemnation of such property is the talk of the day?

The public should see to it that such conditions do not exist. It has an interest greater than the selfish interest of the few who would stop the utility development of every community while their political ambitions are satisfied or a personal grouch is assuaged. It is a sad picture to see a community of inflamed citizens following the leadership of one man, or even several men, in an effort to handicap or destroy a local utility, all because of selfishness on the part of the few self-appointed leaders. This kind of thing has got to stop in this country, otherwise the public will pay the high price of stagnation in such growth, with a breaking down of the service now rendered.

What the people desire most is efficient service, so long as it is furnished at a reasonable price. This they are willing to pay. They have a right to expect both efficient service and reasonable rates at the hands of regulatory commissions. Is it not high time that the public and utility companies throughout the country were coming to a better understanding? . . .

The public is concerned in seeing that light and power companies, both steam and hydro-electric, are built in such large units and so connected as to cover a radius sufficient to overcome the interruptions in service resulting from high and low water, storms, breakdowns and other causes, all of which come at intervals and in spots; and by a proper arrangement for exchange of output between such large companies interruptions in service longer than the time consumed in throwing in a switch would never be heard of. . . .

The time has come when the public must have a broader vision in handling these questions if we are to keep pace with our opportunities for growth and development. We have got to get away from a local consideration of services of this kind. Far better for us that the lights we use in our homes and the power we use in our local enterprises be derived from power even hundreds of miles away from us, with such an interrelation of service as has just been mentioned, if by such an arrangement we have an added guarantee of continuous service.

SECURITY HOLDERS MUST INCREASE IN NUMBER

I cannot believe the public will stand for a reactionary program that will certainly carry us back to crude methods, with less service and at higher rates. We may halt, temporarily, here and there over the country, but in the end electric power supply, as well as other utility services, is going to be carried on in a wholesale manner. Any other method is squarely in the teeth of the very fiber of our people and form of government. There are 1,450,000 citizens of our country who have invested in the securities of the electric light and power companies of America. This number should be increased many times. Indeed, such a new class of investors may in the end become the only solution of the problem of financing the present needs of our utility companies—saying nothing of the future—if such companies are to keep pace in development and expansion as the public needs require. Either the public will have to assume and practice a more friendly attitude toward capital belonging to the other fellow or the public will have to put up the cash, and from a class who have heretofore studiously avoided such investments.

This brings us face to face with the issue confronting the public utilities of the nation today. They have not the financial strength of expansion, and in many cases this came to be so from the fact that they have been required by regulatory boards to operate on rates that were too low. This issue should be presented to the public that it may decide for itself the manner in which such financing hereafter shall be done. If private citizens refuse to furnish the money, then the public must inform the other fellow that efforts at condemnation or confiscation of his property will not be tolerated.

Cost of Improved Street Lighting Not the Deciding Factor

Civic Pride of Stamford, Conn., and Belief that Traffic Accidents Would Be Decreased by Better Illumination Were Factors in Increasing Yearly Lighting Expense More Than 50 per Cent

By W. D. JENNINGS

IF CITY officials are not interested in improving their street lighting because of civic pride, they will at least be interested because of the definite bearing that proper illumination has on traffic accidents. When the subject of improved lighting is properly placed before the various business organizations there will seldom be any protest against the additional expense. This was found to be true at Stamford, Conn., where one of the best and most artistic ornamental street-lighting systems in the East has recently been placed in operation. The Stamford Gas & Electric Company assumed the entire cost of the equipment and installation, but the new street-lighting contract will cost the city $47,575, as against the previous expenditure of $30,680 yearly. Although the use of luminous-arc lamps for ornamental street lighting is well established and they continue to hold the field where high intensities and low maintenance costs are chiefly considered, there are several interesting features regarding the Stamford installation which merit recording.

The previous lighting equipment was in no sense obsolete, showing lighting intensities of 0.27 foot-candle on the principal business street. In the business and in part of the residential section 134 direct-current 6.6-amp. series pendent luminous-arc lamps of the Boston type were installed, equipped with opal globes and mounted two on a pole in the business section and singly in the secondary business district. The lamps were on one side of the street only. The price paid per lamp per year was $90 for overhead construction, $120 for underground, for 4,000 lighting hours. Eighty of these pendent-type lamps will be retained in service in the outskirts of the new lighting zone.

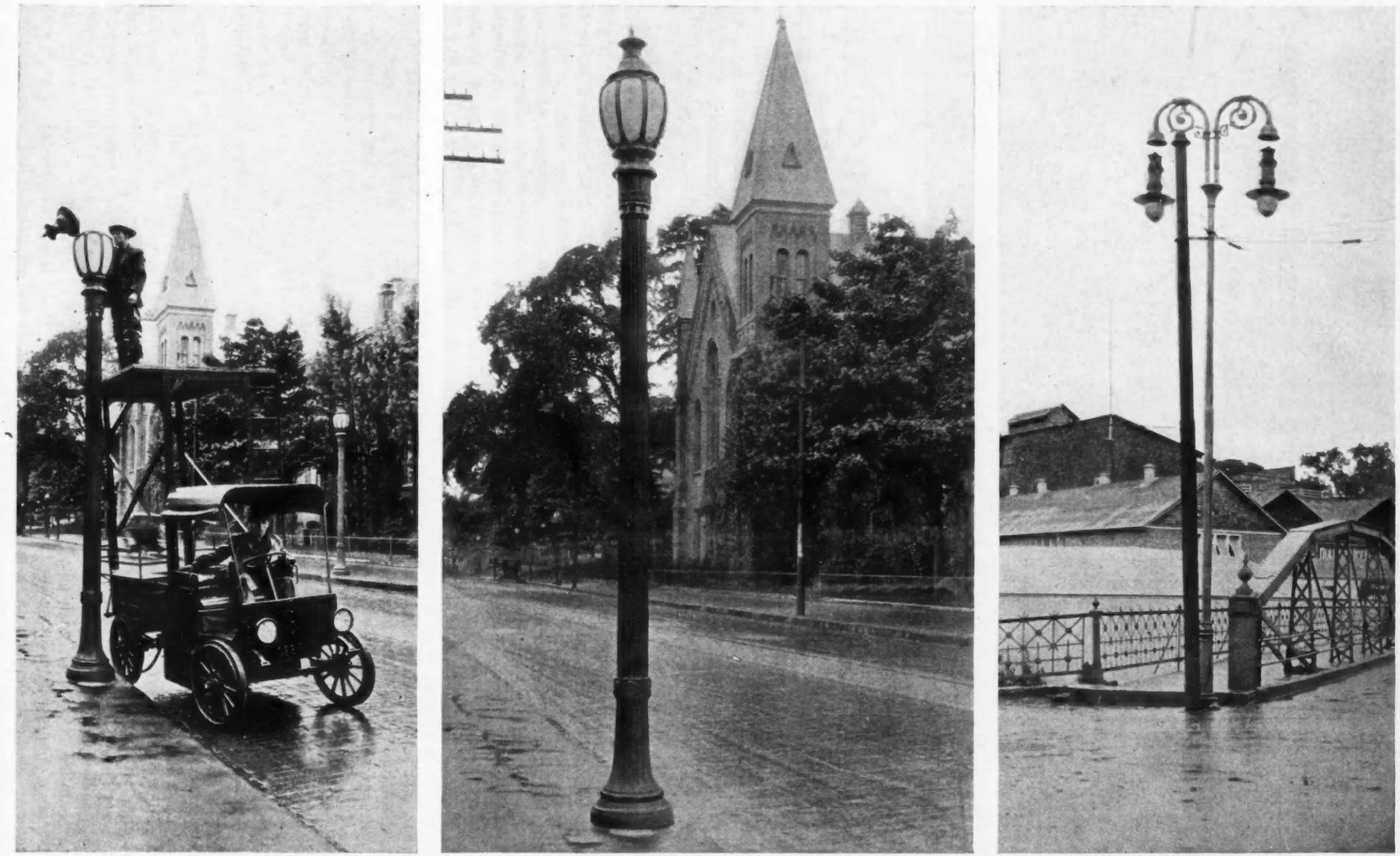
The new equipment consists of 150 direct-current 6.6-amp. series ornamental luminous-arc lamps, equipped with eight-panel alabaster globes of pleasing design. The lamps are mounted on the top of ornamental posts with a mounting of 14 ft. 6 in. (4.35 m.) to the light source.

The standards are erected approximately 100 ft. (30 m.) apart on each side of the street in a staggered arrangement. The lamps are operated from two circuits, so that those on alternate sides of the street can be extinguished after midnight, with the exception of lamps adjacent to the Town Hall, which burn all night. Each lamp has a series absolute plug cut-out installed in the base of the ornamental pole. When the plug is removed all connection between lamp and line is absolutely broken.

For convenience in trimming, a 750-lb. (340-kg.) electric truck was converted into a tower wagon. This has been found almost indispensable when changing arc lamps or cleaning the globes, and in addition it is used for renewing burned-out series incandescent lamps.

The new system employs the latest improvements in design of arc lamps for street-lighting service. In principle these lamps are the same as the older forms of pendent and ornamental luminous-arc lamps, although a number of detail changes have been made in order to provide better electrical insulation and make the lamp

Modern Lighting Is a Great Help in Adorning City Streets and Preventing Accidents



ORNAMENTAL POSTS WITH EIGHT-PANEL ALABASTER GLOBES INCLOSING 6.6-AMP. SERIES LUMINOUS-ARC LAMPS REPLACED THE OLD PENDENT LAMPS SHOWN AT THE RIGHT. THE PENDENT TYPE, HOWEVER, IS RETAINED IN THE OUTSKIRTS OF THE LIGHTING ZONE. AT THE LEFT IS SHOWN AN ELECTRIC TRUCK USED FOR TRIMMING, CLEANING, ETC.

easier to maintain and also more reliable in service. The electrodes used in these lamps are, of course, the vital feature around which the lamp has been developed. The upper electrode, which operates as positive, is a solid rod of copper and is relatively non-consuming—8,000 hours to 10,000 hours' life being obtained from a single electrode. The lower, or negative, electrode is composed of metallic oxides packed into an iron tube and in these lamps burns for about 125 hours. The principal ingredients of the electrodes are natural oxide of iron, titanium and chromium. The purest of ores are used, and the greatest care is exercised in purifying and grinding them.

The calculated illumination value on the street surface along the center line of a street is an average of 0.350 foot-candles. On referring to the night view the even distribution and absence of shadows will be observed.

AFFORDS BETTER VISION

In addition to the general pleasing effect produced by the soft whiteness of the light from the luminous arc, it also seems to afford better vision along the street than the yellow tones of light. Particularly is this noticeable as contrasted with the ordinary yellowish light in store windows. Instead of reducing the apparent brilliancy of the window, the difference in color serves to introduce a contrast that accentuates both the street illumination and the window display.

The luminous-arc lamps are operated from series mercury-arc rectifiers, but to insure continuity of operation the duplicate double-tube rectifier was specified. This outfit consists of a seventy-five-light rectifier, two tubes in series, of standard construction, but with a special tube tank. The tank is so modified that each tube has a duplicate tube on a separate holder connected in multiple with it. Glass inserts in the tube-tank lids enable the operation to be observed without raising the lids. A guiding arrangement facilitates inserting the tube-holder pin into the shaking mechanism. The advantage of this design lies in the fact that operation is not suspended when a tube fails, as the tube in multiple will carry the load while replacement is being made. The price per lamp per year is $120 for about 3,000 lighting hours. The contract covers ten years from date of installation.

In addition to the ornamental lighting, the series incandescent system was improved by replacing about 931 60-cp. 6.6-amp. "Mazda B" series lamps, furnished at $20 per lamp per year for 4,000 lighting hours, with 960 100-cp., 6.6-amp. "Mazda C" series lamps, at $25 per lamp per year underground for 4,000 lighting hours.

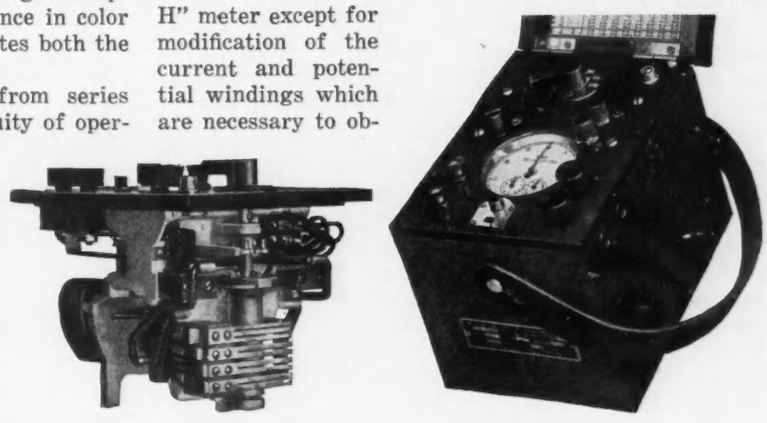
Not the least important part of any ornamental system is the manner of supplying the energy, which in most cases is through underground circuits. Because of the use of band-steel armored cables it was unnecessary to tear up the streets. Without the slightest annoyance or inconvenience to traffic, there was placed underground 9,000 ft. (2,740 m.) of No. 6 stranded and 8,000 ft. (2,430 m.) of No. 6 two-conductor varnished-cambric, lead-covered, band-steel-armored cable. For connecting the old underground cables with the new ones single-conductor and duplex-conductor varnished-cambric, lead-covered cable was used.

The armored cable was laid close to the street side of the curb, and the trench was prepared by the use of a specially designed gasoline-engine compressor, mounted on a truck body for portability. The compressor was of sufficient capacity to operate six "guns." After the desired length of trench was opened, the cable was laid in, covered with wooden strips, and concrete which was prepared by a power-driven mixer was poured flush with the street surface, which is of vitrified brick.

The luminous-arc lamps, cut-outs, cables and mercury-arc rectifier equipment were furnished by the General Electric Company, Schenectady, N. Y.; the ornamental poles by the Union Metal Manufacturing Company, Canton, Ohio, and the installation work was done by the Central Station Equipment Company, New York.

Portable Device for Testing Watt-Hour Meters Without Stop Watches

A PORTABLE test meter for checking the accuracy of a service-type watt-hour meter has been developed by the Sangamo Electric Company which requires no indicating instruments or stop watches and automatically compensates for variations in load and voltage. The moving system of this meter is essentially the same as that used in the standard Sangamo "type H" meter except for modification of the current and potential windings which are necessary to obtain the various ranges of the standard. The meter is designed for various ratings, the changes being effected by rotation of a drum controller operated by a dial switch on the cover.



DRUM CONTROLLER AND EXTERIOR OF PORTABLE TEST SET

Contrary to the usual practice, the current for heavy loads is carried by multiple-leaf brushes bearing down on two sides of a flat disk with considerable pressure. This arrangement provides a greater contact area, which, with the pressure exerted, minimizes the contact resistance and possibility of heating. For the lower capacities the usual leaf brush is utilized.

The standard meter is arranged for 110-volt and 220-volt operation, the changes from one voltage to another being accomplished by means of a rotating switch. When additional voltage ranges are required, multipliers are used.

The register is of the three-pointer type. The larger circle represents a single revolution of the disk and is divided into hundredths. The two smaller pointers make one revolution for each ten and each hundred revolutions of the disk respectively. A resetting device is provided consisting of a small button on the top of the case so aranged that upon applying a slight pressure the hands are immediately returned to zero.

Practical Method for Calculating Operating Characteristics of Magnet Coils

An Analysis of the Fundamental Considerations in Estimating the Current-Time Relations in Magnet Coils and the Distribution of Energy in the Electric and Magnetic Circuits, with Examples Showing the Applications of the Method

By CHARLES R. UNDERHILL
Consulting Electrical Engineer

THE object of this article is to provide a method for quickly estimating the current-time relations in an electric circuit containing only resistance and inductance, as well as the distribution of energy in the electric and magnetic circuits. Examples are given to show the applications of the method. Then follows the mathematical demonstration of the principles involved. The accompanying tables are unnecessarily accurate for ordinary calculations, but their accuracy will be appreciated in special cases.

At the instant the terminals of an electromagnet, or the primary of an induction coil, are connected to the terminals of a storage battery, for instance, so that the emf., E, of the battery, impressed upon the coil tends to cause a current of instantaneous strength, i, to flow in the turns of wire in the coil, the current strength tends to increase at a time-rate

$$di/dt = E/L \text{ amp. per second,} \qquad (1)$$

wherein L is the inductance, in henries, when the current strength, i, approximates zero. But after a comparatively small time interval the current strength will approximate a maximum, I, as limited by the resistance, R, of the coil, and then the time-rate of change in the current strength approximates zero. During the time interval while i is changing from 0 to I the electrical energy abstracted from the battery and applied to the coil is converted into

a — magnetic energy; stored in the magnetic circuit.
b — thermal energy; distributed heat.
c — potential electrical energy; stored in the dielectric or insulation between the turns of wire in the coil.

If no relative motion occurs between any of the parts of the electromagnet, no mechanical work will be done, and this is the condition assumed in this article. The permeability of the magnetic material in the electromagnet changes as the current strength increases from 0 to I, thus causing the inductance (and the permeance) of the electromagnet to vary. Heat is developed in the wire of the coil, owing to the phenomenon of resistance; in the magnetic circuit of the electromagnet, owing to magnetic hysteresis, and in all metal parts interlinked with the magnetic field, owing to eddy currents.

In consequence of the distribution of the energy in the electromagnet, originally obtained from the battery, the familiar equation

$$i = \frac{E}{R}\left(1 - \frac{1}{\epsilon^{(R/L)t}}\right) \text{ amp.} \qquad (2)$$

does not correctly express the relations between the instantaneous current strength, i, and any time interval, t, because the inductance, L, is variable and the effects due to hysteresis, eddy currents and the distributed capacitance of the coil are not considered in the equation. However, equation (2) holds approximately in cases where the inductance is fairly constant, as in electromagnets designed to pull light loads with relatively weak magnetizing forces and to start their loads moving after the lapse of a brief time interval from the instant the electric circuit is closed.

Tables I and II have been calculated as aids in quickly estimating the current strength, i, at the end of any time interval, t, or to estimate the time interval required for the current to attain a given strength after the instant the electric circuit is closed. In this method there is provided a time interval, T, which is used as a standard with which to compare any other time interval, t, thus making it possible to prepare tables wherein ratios t/T may be compared with ratios i/I, and *vice versa*. This standard time interval, T, is equal to ten times the time interval required for the current strength, i, to attain one-half of its maximum, I, and is equal to 6.9315 times the ordinary time-constant, L/R. Therefore,

$$T = 10\ L/R \log 2 = 6.9315\ L/R \text{ second} \qquad (3)$$

represents a time interval during which the instantaneous current strength, i, increases from 0 to 0.99902 I;

TABLE I—VALUES OF i/I ARE CALCULATED FROM EQUATION (6) BY ASSUMING VALUES FROM 0.01 TO 1.00 FOR t/T

t/T	i/I	t/T	i/I	t/T	i/I
0.01	0.066967	0.36	0.917531	0.71	0.992711
0.02	0.129449	0.37	0.923054	0.72	0.993199
0.03	0.187748	0.38	0.928206	0.73	0.993654
0.04	0.242142	0.39	0.933014	0.74	0.994079
0.05	0.292893	0.40	0.937500	0.75	0.994476
0.06	0.340246	0.41	0.941685	0.76	0.994846
0.07	0.384428	0.42	0.945591	0.77	0.995191
0.08	0.425651	0.43	0.949234	0.78	0.995513
0.09	0.464113	0.44	0.952634	0.79	0.995813
0.10	0.500000	0.45	0.955806	0.80	0.996094
0.11	0.533484	0.46	0.958765	0.81	0.996355
0.12	0.564725	0.47	0.961527	0.82	0.996599
0.13	0.593874	0.48	0.964103	0.83	0.996827
0.14	0.621071	0.49	0.966507	0.84	0.997040
0.15	0.646447	0.50	0.968750	0.85	0.997238
0.16	0.670123	0.51	0.970843	0.86	0.997423
0.17	0.692214	0.52	0.972795	0.87	0.997595
0.18	0.712825	0.53	0.974617	0.88	0.997756
0.19	0.732057	0.54	0.976317	0.89	0.997907
0.20	0.750000	0.55	0.977903	0.90	0.998047
0.21	0.766742	0.56	0.979383	0.91	0.998178
0.22	0.782362	0.57	0.980763	0.92	0.998300
0.23	0.796937	0.58	0.982052	0.93	0.998414
0.24	0.810535	0.59	0.983254	0.94	0.998520
0.25	0.823223	0.60	0.984375	0.95	0.998619
0.26	0.835062	0.61	0.985422	0.96	0.998711
0.27	0.846107	0.62	0.986398	0.97	0.998798
0.28	0.856413	0.63	0.987309	0.98	0.998878
0.29	0.866028	0.64	0.988159	0.99	0.998953
0.30	0.875000	0.65	0.988952	1.00	0.999023
0.31	0.883371	0.66	0.989691	....	.....
0.32	0.891181	0.67	0.990382	....	.....
0.33	0.898470	0.68	0.991026	....	.....
0.34	0.905268	0.69	0.991627	....	.....
0.35	0.911612	0.70	0.992188	....	.....

that is, to $i/I = 0.99902$. For purposes of ordinary calculations i may be considered equal to I at the end of the standard time interval, T. It is to be noted that, whereas the instantaneous current strength, i, approaches the steady current strength, I, as a limit or asymptote, there is no limit to the time interval, t, which may become greater than the standard time interval, T.

Let it be assumed that a circuit contains only resistance and inductance and that both are constant during the time interval when the current strength is changing from 0 to I and that the effects of hysteresis, eddy currents and capacitance are absent. The current-time relations will then be correctly expressed by equation (2). Further assumptions are that the resistance, in ohms, and the inductance, in henries, are known.

TABLE II—VALUES OF t/T ARE CALCULATED FROM EQUATION (5) BY ASSUMING VALUES FROM 0.01 TO 0.9999 FOR i/I

i/I	t/T	i/I	t/T	i/I	t/T
0.01	0.00144996	0.36	0.0643856	0.71	0.178588
0.02	0.00291463	0.37	0.0666576	0.72	0.183650
0.03	0.00439435	0.38	0.0689660	0.73	0.188897
0.04	0.00588938	0.39	0.0713119	0.74	0.194342
0.05	0.00740006	0.40	0.0736965	0.75	0.200000
0.06	0.00892672	0.41	0.0761213	0.76	0.205889
0.07	0.0104698	0.42	0.0785875	0.77	0.212029
0.08	0.0120294	0.43	0.0810966	0.78	0.218442
0.09	0.0136062	0.44	0.0836501	0.79	0.225154
0.10	0.0152003	0.45	0.0862496	0.80	0.232193
0.11	0.0168123	0.46	0.0888969	0.81	0.239593
0.12	0.0184424	0.47	0.0915936	0.82	0.247393
0.13	0.0200913	0.48	0.0943417	0.83	0.255639
0.14	0.0217591	0.49	0.0971431	0.84	0.264386
0.15	0.0234465	0.50	0.100000	0.85	0.273697
0.16	0.0251539	0.51	0.102915	0.86	0.283650
0.17	0.0268817	0.52	0.105889	0.87	0.294342
0.18	0.0286304	0.53	0.108927	0.88	0.305889
0.19	0.0304006	0.54	0.112029	0.89	0.318442
0.20	0.0321928	0.55	0.115200	0.90	0.332193
0.21	0.0340075	0.56	0.118442	0.91	0.347393
0.22	0.0358454	0.57	0.121759	0.92	0.364386
0.23	0.0377070	0.58	0.125154	0.93	0.383650
0.24	0.0395929	0.59	0.128630	0.94	0.405889
0.25	0.0415037	0.60	0.132193	0.95	0.432193
0.26	0.0434403	0.61	0.135845	0.96	0.464386
0.27	0.0454042	0.62	0.139593	0.97	0.505889
0.28	0.0473933	0.63	0.143440	0.98	0.564386
0.29	0.0494110	0.64	0.147393	0.99	0.664386
0.30	0.0514573	0.65	0.151457	0.9999	1.32877
0.31	0.0535332	0.66	0.155639	....	.....
0.32	0.0556393	0.67	0.159946	....	.....
0.33	0.0577767	0.68	0.164386	....	.....
0.34	0.0599462	0.69	0.168966	....	.....
0.35	0.0621488	0.70	0.173697	....	.....

EXAMPLES THAT EXPLAIN THE USES OF TABLES I AND II

Example 1.—The maximum current strength, I, as determined by dividing the constant continuous impressed emf., E, in volts, by the resistance, R, in ohms, is 0.5 amp., and the quotient obtained by dividing the inductance, L, in henries, by the resistance, in ohms, is equal to 0.015, which is the ordinary time constant. What will be the instantaneous current strength, i, 0.025 second after the electric circuit has been closed?

Since $T = 6.9315\ L/R$, and $L/R = 0.015$,

$$T = 6.9315 \times 0.015 = 0.104 \text{ second.}$$

Therefore, $t/T = 0.025/0.104 = 0.2404$.

Referring to Table I, when $t/T = 0.24$, $i/I = 0.81$, and, since it is known that $I = 0.5$ amp., $i = 0.81 \times 0.5 = 0.405$ amp. Therefore, under the conditions imposed in this example, the instantaneous current strength will be 0.405 amp. after the circuit has been closed for 0.025 second.

Example 2.—With the same values for inductance, resistance and maximum current strength, I, as given in Example 1, find the time required for the current to attain 50 per cent of its maximum strength; that is, for i to become equal to $0.5I = 0.25$ amp.

Referring to Table II, when $i/I = 0.5$, $t/T = 0.10$. But $T = 0.104$ second, as in Example 1. Therefore, $t = 0.1T = 0.0104$ second. Consequently, after the electric circuit has been closed for 0.0104 second the current strength will be 0.25 amp.

In this method either table may be used in the calculation of either i/I or t/T. Also, interpolation may be made when conditions require it.

Example 3.—Let it be assumed that the current strength, i, must be 2 amp. after a constant continuous emf., E, has been impressed upon a coil for a time interval, t, of 0.010 second. What will be the proper value of L/R? From equation (3), $T = 6.9315\ L/R$ second. Therefore, in this case,

$$t/T = 0.010R/6.9315L = 0.0014427\ R/L,$$

and

$$L/R = 0.0014427/(t/T) \text{ second.}$$

If the values of the constant continuous impressed emf. and the resistance are such that the maximum current strength would be, say, 10 amp., then $i/I = 0.2$. Referring to Table II, when $i/I = 0.2$, $t/T = 0.0322$. Therefore,

$$L/R = 0.0014427/(t/T) = 0.0014427/0.0322 = 0.0448 \text{ second.}$$

In other words, the time constant of the circuit must be 0.0448 second, and the inductance and resistance must be proportioned accordingly.

The upper curve shown on page 874 graphically expresses the principles involved and is sufficiently accurate for ordinary use. There are 199 points in this dotted curve, and each represents one of the co-ordinates as given in these tables.

To find the total energy, W_t, in joules abstracted from the electric circuit at the end of any time interval, t, first find $T = 6.9315\ L/R$, and obtain the value of the ratio t/T. From Fig. 2, find the value of Q/Q_T corresponding to t/T. Then multiply the value of Q/Q_T thus found by $5.91LI^2 = 5.91IE(L/R)$.

The magnetic energy in joules stored during the time interval t, is equal to $\frac{1}{2}\ Li^2$. The value of i is found as explained in Example 1.

The energy in joules converted into heat during the same time interval is equal to the difference between the total energy in joules abstracted from the electric circuit and that converted into magnetic energy. Therefore, to find the energy in joules converted into heat in the electric circuit, subtract $\frac{1}{2}\ Li^2$ from the total electric energy in joules abstracted from the electric circuit during the time interval t.

Example 4.—The inductance of a circuit is 0.1 henry and the resistance is 5 ohms. If a constant continuous emf. of 10 volts is impressed upon this circuit, what will be (a) the total electrical energy delivered to the electric circuit and reconverted into magnetic energy and heat at the end of a time interval of 0.03 second? and (b) how much of this energy will be converted into magnetic energy and how much will be converted into heat?

TABLE III—ELEMENTS UPON WHICH DATA OF TABLES I AND II ARE BASED

$\frac{i}{I}$	$\frac{I}{I-i}$	$\frac{t}{(L/R)}$	$\frac{t}{T} = \frac{t/(L/R)}{10 \log 2}$
0.	1	$\log 1 = 0$	0
0.5	2	$\log 2 = 0.69315$	0.1
0.75	4	$\log 4 = 1.38630$	0.2
0.875	8	$\log 8 = 2.07945$	0.3
0.9375	16	$\log 16 = 2.77260$	0.4
0.96875	32	$\log 32 = 3.46575$	0.5
0.984375	64	$\log 64 = 4.15889$	0.6
0.9921875	128	$\log 128 = 4.85204$	0.7
0.99609375	256	$\log 256 = 5.54519$	0.8
0.998046875	512	$\log 512 = 6.23834$	0.9
0.9990234375	1,024	$\log 1{,}024 = 6.93150$	1.0

(a) The time constant is $L/R = 0.1/5 = 0.02$ second. Therefore, $T = 6.9315\ L/R = 0.13863$ second, and $t/T = 0.03/0.13863 = 0.2164$. Referring to Fig. 2, when $t/T = 0.2164$, $Q/Q_T = 0.124$ (about). Multiplying this value of Q/Q_T by $5.91LI^2$ gives $0.124 \times 5.91 \times 0.1 \times 4 = 0.293$ joules (approximately) as the total electrical energy delivered to the electric circuit.

(b) Referring to Table I, when $t/T = 0.21$, $i/I = 0.7667$, and when $t/T = 0.22$, $i/I = 0.7824$. Therefore, when $t/T = 0.2164$, i/I has a value between 0.7667 and 0.7824. A difference in $t/T = 0.22 - 0.21 = 0.01$ produces a corresponding difference in $i/I = 0.7824 - 0.7667 = 0.0157$. Consequently, a difference in $t/T = 0.2164 - 0.21 = 0.0064$

produces a difference in $i/I = (0.0157/0.01) \times 0.0064 = 1.57 \times 0.0064 = 0.01$. Hence, when $t/T = 0.2164$, $i/I = 0.7667 + 0.01 = 0.777$ (approximately). $I = E/R = 10/5 = 2$ amp. Therefore, $i = 0.777I = 1.554$ amp. at the expiration of the 0.03-second time interval. The magnetic energy abstracted from the electric circuit during this time interval is equal to $\frac{1}{2} Li^2 = (0.1 \times 1.554^2)/2 = 0.05 \times 2.415 = 0.121$ joule. Therefore, the energy abstracted from the electric circuit and converted into heat during the time interval of 0.03 second is equal to $0.293 - 0.121 = 0.172$ joule.

The above method is based upon the following principle:

Rearranging equation (2),

$$t = \frac{L}{R} \operatorname{logh} \frac{1}{1 - (i/I)} \text{ second.} \tag{4}$$

Therefore,

$$\frac{t}{T} = \frac{\operatorname{logh} \frac{1}{1 - (i/I)}}{10 \operatorname{logh} 2},$$

or

$$\frac{t}{T} = 0.1 \log_2 \frac{1}{1 - (i/I)}. \tag{5}$$

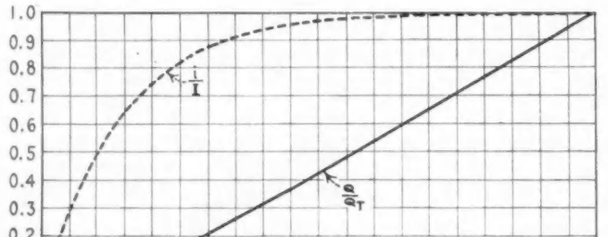
By rearranging equation (5),

$$\frac{1}{1 - (i/I)} = 2^{10(t/T)}, \qquad 1 - (i/I) = 2^{-10(t/T)},$$

and

$$i/I = 1 - 2^{-10(t/T)}. \tag{6}$$

The values of i/I in Table I have been calculated from



RELATIONS OF i/I AND Q/Q_T WITH t/T

Relation between i/I and t/T plotted from values in Tables I and II. Relation between Q/Q_T and t/T obtained by planimetering the dotted curve and dividing the results by 0.853.

equation (6) by assuming values from 0.01 to 1.00 for t/T, while the values of t/T in Table II have been calculated from equation (5) by assuming values from 0.01 to 0.9999 for i/I. In order to perform these calculations, it is convenient to use the logarithmic base 10.

Referring to equation (5),

$$\log_2 \frac{1}{1 - (i/I)} = \frac{\log_{10} \frac{1}{1 - (i/I)}}{\log_{10} 2} = \frac{\log_{10} \frac{1}{1 - (i/I)}}{0.30103}.$$

Substituting this value of $\log_2 \frac{1}{1 - (i/I)}$ into equation (5),

$$\frac{t}{T} = \frac{0.1}{0.30103} \log_{10} \frac{1}{1 - (i/I)},$$

or

$$\frac{t}{T} = 0.332193 \log_{10} \frac{1}{1 - (i/I)}. \tag{7}$$

Rearranging equation (7),

$$\frac{1}{1 - (i/I)} = 10^{3.0102(t/T)}, \quad 1 - (i/I) = 10^{-3.0102(t/T)},$$

and

$$i/I = 1 - 10^{-3.0102(t/T)}. \tag{8}$$

Equation (8) may be written,

$$i/I = 1 - 10^{-10 \log_{10} 2 (t/T)}. \tag{9}$$

Table III clearly shows the principle upon which Tables I and II (particularly Table I) are based.

Rearranging equation (4),

$$t/(L/R) = \operatorname{logh} [I/(I - i)]. \tag{10}$$

Therefore, when $i = 0.5I$, $t = (L/R) \operatorname{logh} 2 = 0.1T$.

The expression $\epsilon^{(R/L)t}$ in equation (2) is equal to E/e_L wherein

$$e_L = L(di/dt) \text{ volts} \tag{11}$$

is the emf. of self-induction, which is equal to E at the instant the electric circuit is closed, but decreases to 0 by the time that the current strength, i, has attained its maximum, I (theoretically, after an indefinite time interval), and the time-rate of change in the current strength is 0.

The active emf.,

$$e_R = iR \text{ volts} \tag{12}$$

is equal to the difference between the constant continuous impressed emf., E, and the emf. of self-induction, e_L, or

$$e_R = E - e_L \text{ volts} \tag{13}$$

and varies from 0 at the instant that the electric circuit is closed, to E by the time the current has attained its maximum strength.

The induced emf., $-e_L$, is numerically equal, but opposite in sign, to the emf. of self-induction, which is expressed as e_L.

Substituting E/e_L for $^{(R/L)t}$ in equation (2),

$$i = \frac{E}{R}\left(1 - \frac{e_L}{E}\right) = \frac{E - e_L}{R} = \frac{e_R}{R} \text{ amp.} \tag{14}$$

whence,

$$e_R = iR \text{ volts.} \tag{15}$$

The time rate at which electric energy is converted into magnetic energy is

$$P_m = e_L i \text{ watts,} \tag{16}$$

and the magnetic energy stored at the end of any time interval, t, is

$$W_m = \int_o^t P_m dt = \int_o^t (e_L i)\, dt = \tfrac{1}{2} Li^2 \text{ joules.} \tag{17}$$

The time rate at which electrical energy is converted into thermal energy, or heat, in the wire of the coil is

$$P_R = e_R i \text{ watts,} \tag{18}$$

and the heat stored in the coil at the end of any time interval, t (provided that no heat escapes), is

$$W_R = \int_o^t P_R dt = \int_o^t (e_R i)\, dt \text{ joules.} \tag{19}$$

The total energy abstracted from the electric circuit during any time interval, t, is

$$W_t = W_m + W_R = E \int_o^t i dt = EQ \text{ joules,} \tag{20}$$

wherein W_m is the magnetic energy, W_R is the thermal energy and Q is the quantity of electricity, in coulombs, which has flowed during this time interval, t.

The total area under the dotted curve indicates that the total quantity of electricity, Q_T, which would flow through a plane in the cross-section of the electric circuit during a time interval $T = 6.9315\ (L/R) = 1$ second, with a maximum current strength, $I = 1$ amp., would be equal to 0.853 coulomb (approximately); that is, when $I = 1$ amp.,

$$Q_T = \int_o^{T=1} i dt = 0.853 \text{ coulomb (approximately).}$$

The full curve shows the relation of Q/Q_T to t/T. This was obtained by planimetering the dotted curve, which was plotted on cross-section paper, and dividing the results by 0.853. Forty equidistant points were selected on the axis of time, the average of several readings being taken for each point. Consequently, when $Q/Q_T = 1$, $t = T = 1$.

When I and T have values other than unity,

$$Q_T = 0.853\,IT = 0.853\,I \times 6.9315\,(L/R) \quad (21)$$
$$= 5.91\,I\,(L/R) \text{ coulombs.}$$

The maximum amount of energy abstracted from the electric circuit at the end of the standard time interval, T, is

$$W_T = EQ_T = 5.91\,EI(L/R) \text{ joules,} \quad (22)$$

and, since the induced emf. then is so small that it may be neglected,

$$E = IR \text{ volts.} \quad (23)$$

Substituting this value for E in equation (22),

$$W_T = IRQ_T = 5.91\,LI^2 \text{ joules.} \quad (24)$$

The energy abstracted from the electric circuit at the end of any time interval, t, is

$$W_t = W_T(Q/Q_T) = 5.91\,LI^2\,(Q/Q_T) = EQ \text{ joules} \quad (25)$$

Substituting this value of W_t into equation (20), and rearranging,

$$W_R = 5.91\,LI^2\,(Q/Q_T) - W_m$$
$$= 5.91\,LI^2\,(Q/Q_T) - \tfrac{1}{2}\,LI^2 \text{ joules} \quad (26)$$

or

$$W_R = L\,[5.91\,I^2(Q/Q_T) - 0.5\,i^2] \text{ joules,} \quad (27)$$

or

$$W_R = (L/2)\,[11.8\,I^2(Q/Q_T) - i^2] \text{ joules.} \quad (28)$$

Light and Power Industry in South Africa*

Central and Isolated-Plant Generator Installation 320,736 Kw.—Output in 1918, About 849,542,280 Kw.-Hr.—Connected Motor-Load, 548,195 Hp.

ALTHOUGH there are only about eighty-one central and isolated electrical power stations in the Union of South Africa, and not more than four in Rhodesia, yet, when the comparatively small white or essentiallly productive population is taken into consideration, the total installed rating of the power stations is rather impressive. The total generator installation at the beginning of 1917 was 320,736 kw., or an average installation of 0.25 kw. per white inhabitant, which is about twice the central-station generator installation per inhabitant in the United States. The total output of these light and power stations in 1918 was 849,542,280 kw.-hr., of which 52,000,555 kw.-hr. was direct current and 797,541,725 kw.-hr. was alternating current. Of the total output 696,179,817 kw.-hr., or 82 per cent, was used for mining purposes. In addition 153,873,180 compressed-air units were sold to mining companies by electric light and power plants, the Victoria Falls & Transvaal Power Company making the sale and distribution of compressed air a large part of its business. There are also many small electric power plants operated by mining companies, and the output of these has not been included in the above figures. Table I gives the output of the four provinces during 1918.

TABLE I—OUTPUT OF SOUTH AFRICAN ELECTRIC LIGHT AND POWER PLANTS DURING 1918

Provinces	Direct Current, Kw.-Hr.	Alternating Current, Kw.-Hr.	Total Output, Kw.-Hr
Transvaal	23,652,205	743,920,960	767,573,165
Cape	21,359,723	28,964,813	50,324,536
Orange Free State	890,936	2,544,813	3,435,749
Natal	6,097,691	22,111,139	28,208,830
Total	52,000,555	797,541,725	849,542,280

On account of the large coal deposits in South Africa steam power predominates among the central and isolated plants. About 90 per cent of the prime movers in the stations are steam turbines, steam engines being used only in the smaller plants. Fuel oil is high, and only a very few gas engines are installed at the present time. South Africa offers small opportunity for water-power development, there being only three plants operated solely by water power and two or three that have a small amount of their capacity in hydro-electric units. The Victoria Falls offer large water-power possibilities, but development of this power site will not be warranted for many years to come on account of lack of a suitable market for the power generated.

In 1917 there were 11,744 motors connected with the electric power plant lines, representing a total load of 548,195 hp. Of this number 4,367 were direct-current motors, totaling 85,347 hp., and 7,377 were alternating-current motors, with a total rating of 462,848 hp. Table II gives the distribution of the generators and motors among the various industries. Under "industrials" are included the light and power companies furnishing energy for lighting purposes.

*The above data are based on a report by R. A. Lundquist, trade commissioner of the Bureau of Foreign and Domestic Commerce.

TABLE II—STATISTICS OF GENERATORS AND MOTORS IN SOUTH AFRICA, 1917

Industries and Districts	Generators: Direct-Current No.	Generators: Direct-Current Kw.	Generators: Alternating-Current No.	Generators: Alternating-Current Kw.	Generators: Total No.	Generators: Total Kw.	Motors: Direct-Current No.	Motors: Direct-Current Hp.	Motors: Alternating-Current No.	Motors: Alternating-Current Hp.	Motors: Total No.	Motors: Total Hp.
TRANSVAAL:												
Gold mining	151	23,759	75	43,866	226	67,625	581	34,457	5,132	363,163	5,713	397,620
Diamond mining	5	1,347	4	3,000	9	4,347	119	8,126	.....	.....	119	8,126
Coal mining	20	815	14	3,300	34	4,115	46	915	79	1,578	125	2,493
Base-mineral mining	8	266	13	1,891	21	2,157	26	542	108	2,636	134	3,178
Industrial and lighting	200	11,348	55	169,813	255	181,161	838	8,034	937	68,617	1,775	76,651
CAPE:												
Diamond mining	28	1,399	6	9,896	34	11,295	207	1,890	279	11,774	486	13,664
Coal mining	2	300	...	.....	2	300	13	205	.....	.....	13	205
Base-mineral mining	9	801	...	.....	9	801	79	1,345	.....	.....	79	1,345
Industrial and lighting	142	9,937	22	6,656	164	16,587	1,414	16,410	384	4,175	1,798	20,585
ORANGE FREE STATE:												
Diamond mining	13	1,136	5	1,100	18	2,236	62	1,118	28	1,661	90	2,779
Coal mining	6	924	1	225	7	1,149	45	1,009	.....	.....	45	1,009
Industrial and lighting	44	623	15	3,342	59	3,965	53	421	184	3,507	237	3,928
NATAL:												
Coal mining	30	2,326	2	503	32	2,829	93	1,851	12	612	105	2,462
Industrial and mining	124	10,058	28	12,111	152	22,169	791	9,025	234	5,125	1,025	14,150
GRAND TOTALS:												
Transvaal	384	37,535	161	221,870	545	259,405	1,610	52,074	6,256	435,994	7,866	488,068
Cape	181	12,437	28	16,546	209	28,983	1,713	19,850	663	15,949	2,376	35,799
Orange Free State	63	2,683	21	4,667	84	7,350	160	2,548	212	5,168	372	7,716
Natal	154	12,384	30	12,614	184	24,998	884	10,875	246	5,737	1,130	16,612
Union of South Africa	782	65,039	240	255,697	1,022	320,736	4,367	85,347	7,377	462,848	11,744	548,195

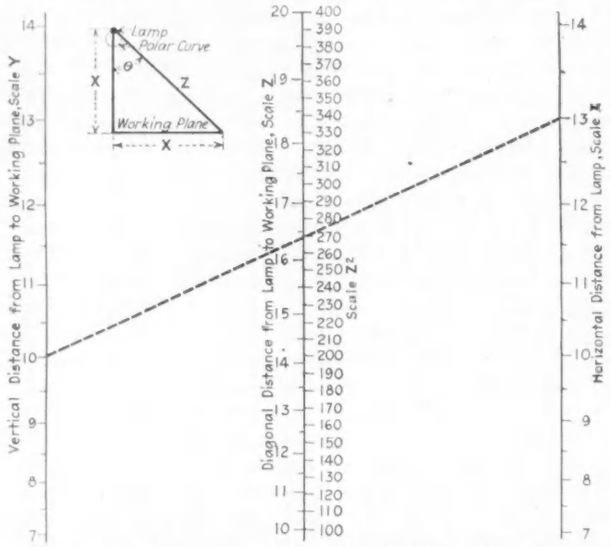
Letters from Our Readers

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Simple Chart for Illumination Calculations

To the Editors of the ELECTRICAL WORLD:

I have had pleasure in reading several articles relative to the art of illumination that have appeared in the ELECTRICAL WORLD, and the curves produced by I. W. Gross* concerning the relation between candle-



STRAIGHT-LINE CHART FOR ILLUMINATION CALCULATIONS

EXAMPLE: To find candlepower of lamps at angle θ, $Y = 10$, $X = 13$, $E_1 = 10$ cp. Then $Z = 16.4$ (from chart), $Z^2 = 269$ (from chart), $I = EZ^2$, $E = E_1Z/Y$, $(10 \times 16.4) \div 10 = E = 16.4$, $I = EZ^2 = 16.4\ (269) = 4{,}420$ cp.

power, intensity of illumination on the horizontal plane and the distance from the unit measured have particularly interested me. I believe that the curves in the form presented by Mr. Gross are very unwieldy and hard to handle. The eye can more readily follow a system of straight lines than a system of curves and straight lines.

I have attempted to produce a chart correcting the conditions just mentioned and at the same time reading in three variables; namely, height of lamp above the working plane (Y), horizontal distance from lamp (X), and the distance (Z) and distance squared (Z^2) from the unit to the point measured, in feet. On the chart the values of Z and Z^2 are plotted for ready determination from values of X and Y.

Let I be the candlepower of the lamp, using fixed values of X, Y and Z. Also let E be the intensity of illumination in foot-candles measured on a plane normal to the line Z and at the distance Z from the lamp. Then $I = EZ^2$, and by knowing the value I or E the value of the other can be found by simple multiplication or division. The component of light falling on the horizontal plane is equal to $E_1 = E(Y/Z)$; also the component of light falling on the vertical plane is equal to $E_2 = E(X/Z)$, thereby placing all calculations in the form of simple multiplication and division and eliminating all calculations involving the square, square root, sine and cosine functions.

The values on the chart may not extend far enough for all calculations, but it can be used for greater values by multiplying each variable (X, Y or Z) by a common number, for example, 2, 3 or 4, which will result in an increase in the range of the chart of two, three and four times.

The average photometer cannot be read any nearer than the Z value of the chart, so that it would be unwise to carry out the calculations to a closer degree of accuracy.

R. H. COOK.

Detroit, Mich.

*ELECTRICAL WORLD, June 19, 1920, p. 1423.

Outdoor Meter Installations Satisfactory

To the Editors of the ELECTRICAL WORLD:

Referring to G. C. Langdell's experience with meters on porches, as recounted in his letter appearing in your issue of July 23, I would say that we have been putting all of our residence meters on the back porch for more than fifteen years and have found the practice very satisfactory. Of course, our climate is considerably different from that of Michigan. Some of these meters are now inside the house, owing to extensions having been built which inclosed them, and nearly all of our trouble with "skips" is caused by these. We do not have any more trouble from meters "going bad" on the porches than we do with those inside and in business houses.

F. V. GALLAUGHER.

Lake Charles Railway, Light & Water Works Company, Lake Charles, La.

Measurement of Volt-Amperes

To the Editors of the ELECTRICAL WORLD:

The editorial in the Sept. 24 issue of the ELECTRICAL WORLD on the "Adjustment of Price to Meet Production Costs" showed an unusually comprehensive grasp of the rate situation in regard to power factor. However, I believe that some of your readers will receive the wrong impression from the following statement in that editorial:

"If the precaution is taken of so adjusting matters that any small error committed by the instrument will be in the customer's favor, we do not see how any public service commission could in the least object to this scheme of operations."

This language is unfortunate in that it makes it appear questionable whether or not the error in using a wattmeter to measure volt-amperes, as described in my article, is always in favor of the customer. The point was definitely covered in the article (page 609, bottom first column). It is comparatively simple to show that this result must necessarily follow. The quantity measured by any wattmeter is $EI \cos \phi$, as is well known. It is also well known that the quantity $\cos \phi$ can never be greater than one. It follows that the quantity $EI \cos \phi$ can never be greater than EI (volt-amperes), no matter how the wattmeter is connected. A connection which will give a quantity greater than volt-amperes (EI) is impossible.

P. M. LINCOLN,
Consulting Engineer.

Lincoln Electric Company, Cleveland, Ohio.

Industrial and Station Practice

Installation, Operation and Maintenance of
Generating and Distribution Equipment and Economical Utilization of Electrical Energy
in Mills and Factories, Including Testing and Repair Methods

Remote-Control Station Makes Small Stream Development Profitable

A REMOTE-CONTROL hydro-electric station has recently been placed in service by the Georgia-Alabama Power Company, which offers a solution of the problem of developing limited-flow streams that could not otherwise be utilized profitably.

The plant in question has a single 300-kva. direct-connected unit and utilizes the full flow of Omussee Creek without pondage. It was constructed as an auxiliary to a somewhat larger plant, containing two 450-kva. units, situated 2 miles higher up on the same stream and possessing the advantage of considerable pondage.

The lower plant is operated without an attendant, being started up, placed in parallel with the upper plant (which feeds transmission lines to nearby cities), and when required disconnected and shut down through the medium of six control lines joining the two plants and strung on the same poles as those which carry the main 2,300-volt leads. Necessary adjustments of the load are also controlled in this manner.

The cycle of starting the remote unit and placing it into service is substantially as follows:

By means of two of the control lines a small solenoid is energized from the exciter circuit of the upper plant which lifts the pilot valve of the governor against the retarding action of a dashpot to prevent a too rapid opening of the gates. The unit comes slowly up to speed, bringing with it the belt-driven exciter, and since the latter is permanently connected to the generator slip rings the generator also builds up its voltage. When the unit approaches within a few per cent of normal speed it comes within the regulating range of the hydraulic governor, which assumes control of the speed. As a means of obtaining control over the generator voltage before synchronizing a Tirrill regulator was installed in the remote plant and the circuit of its alternating-current coil was extended to the upper plant through two control lines, a dial rheostat being inserted in the circuit at that point. Variations of this resistance weaken or strengthen the regulator coil, and this is reflected in increased or decreased generator voltage.

Final close adjustments of speed of the units are made through the usual small synchronizing motor with a range of approximately 5 per cent in speed adjustment above and below normal. This latter motor is energized through the last two control lines, using one of the starting solenoid lines as a return. Synchronizing is then carried out at the upper plant and division of load and adjustment of voltage is carried out as outlined above.

The unit is usually operated at a fixed load to utilize the full volume of water discharged by the upper plant, the principal variations of load being assumed by the upper plant; but complete control of the load on the remote unit is always in the attendant's hand through the medium of the governor motor as explained above.

Consideration was given to elimination of the hydraulic governor and substitution of motor-operated headgates, but this was rejected owing to the small capacity of the upper units and their inability to handle maximum-load peaks, some of which must be thrust on the remote unit. There are doubtless many instances under which an even simpler scheme of complete remote control may be applied than was found to be expedient in this case. Where the size of the remote unit or the value placed on its continuous operation will justify, consideration should be given to the provision of differential relay protection as a safeguard against self-destruction on the occurrence of trouble in its windings, and to bearing thermostats and a centrifugal overspeed device to meet the emergency of runaway or overheating bearings. Any one of these devices may be so interlocked with the starting solenoid on the governor as to shut the unit down in the event of trouble.

Had the load to be served by the two plants contained enough synchronous equipment to furnish the necessary exciting current, an induction generator might have been used and both exciter and governor eliminated, resulting in the utmost simplicity of equipment obtainable.

L. H. HARDIN,
Electrical Engineer.
Mees & Mees, Consulting Engineers,
Charlotte, N. C.

Phase-Rotation and Synchronizing Tests for a New Alternator

THE consequences of paralleling a new or rewound alternating-current generator without first having made a careful check of the synchronizing connections and relative phase rotation of the new unit and bus may be serious and should never be risked. The procedure outlined herein has been prepared for field superintendents of Stone & Webster, Inc.

In cases where two buses with selector oil circuit breakers, or a bus-tie breaker, are available it is a simple matter to check rotation by means of transformers and a small motor or a phase-rotation indicator. To avoid possibility of error, the connections should be so made that it will be unnecessary to change them while rotation is being checked from each source.

In single-bus installations difficulties in following this method may be met. This is particularly true of the installations of higher voltage where small-capacity transformers and motor may not be available. Moreover, by this method it is necessary to do a part of the switching by means of disconnecting switches, which is inadvisable. The following procedure has been prepared for such cases and presupposes that the generator has been dried and subjected to a potential test and is otherwise prepared for service. This scheme considers

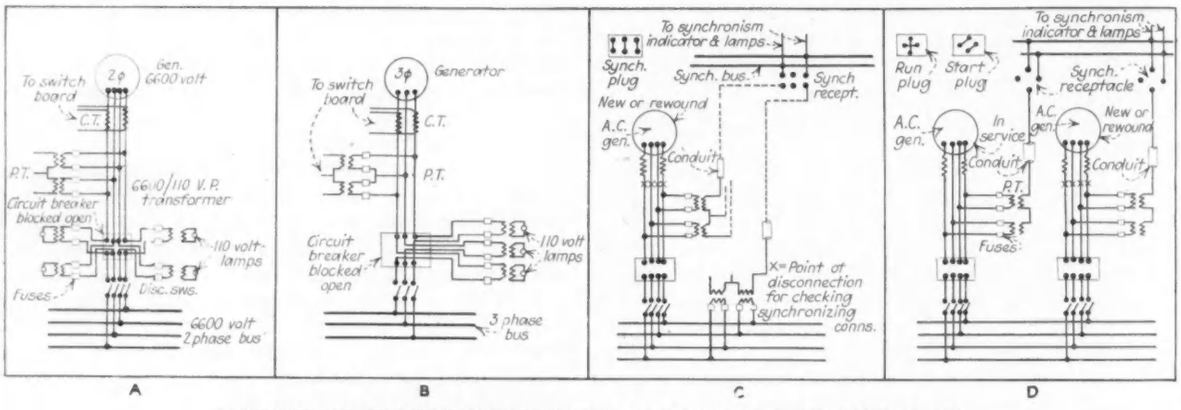
a two-phase, 6,600-volt, four-wire generator (see A), but may be adapted to a three-phase generator (see B).

Connect one 6,600/110-volt potential transformer (fused on high-tension side) across each pole of the generator oil circuit breaker, having this breaker blocked in the open position. Connect one 110-volt lamp across the low-tension side of each transformer.

Run the generator at approximately synchronous speed and regulate the voltage to correspond to the bus voltage, then close generator disconnecting switches.

If the leads of the generator are properly connected to the circuit breaker, all four lamps will vary in brilliancy in like manner; *i.e.*, all lamps will be bright or all lamps will be dark at the same instant.

In case two lamps on one phase are bright and the other two are dark at the same instant, one phase of the generator is reversed. Should this condition be found, stop the generator, open the disconnecting switches and interchange the two leads of one phase on the generator side of the breaker and reconnect. Then repeat the test. All lamps should now vary in brilliancy in like manner, indicating that the phase connections are correct and that the phase rotation of the new unit and the bus are identical. Stop the generator, open the disconnecting switches and disconnect the four test transformers from the oil circuit breaker.



DIAGRAMS FOR CHECKING PHASE-ROTATION AND SYNCHROSCOPE CONNECTIONS

A—Two-phase system. Generator terminals are diagrammatic only. Test must be made to determine which terminals correspond to each phase. B—Three-phase system. C—Checking synchronizing connections between generator and bus. D—Checking synchronizing connections from generator to generator on a two-phase system.

Procedure for Checking Correctness of Synchronizing Connections

I. By magneto or lamp circuit trace carefully the potential lead used for synchronizing from the synchronizing receptacle on the generator panel back to the potential transformer. Note the 6,600-volt bus to which the corresponding (adjacent) high-tension lead is connected (see C).

II. Next trace similarly the other synchronizing lead from the generator synchronizing receptacle to the bus potential transformer, in order to make certain that the adjacent high-tension lead corresponding to this synchronizing lead is connected to the same 6,600-volt bus as found when checking the generator synchronizing lead. In case synchronizing is done between generators it will be necessary to trace in similar manner the synchronizing lead from another generator panel back to 6,600-volt bus (see D).

III. Disconnect the new generator cables at the most convenient point between the generator terminals and the oil circuit breaker (x in C and D). This point must be so chosen that the generator potential transformers will be connected to the cables between the point of disconnection and the breaker. Carefully tape and support (at the point of disconnection) the end of each cable connected to the breaker.

IV. Move the pointer of the synchronism indicator off the neutral (vertical upright) position so that it forms an angle of approximately 15 deg. with the vertical. This may be accomplished by gently tapping the instrument case or by removing the cover. The following procedure assumes that generators are synchronized to the bus and that connections are made for lamps *dark* at synchronism.

V. Close the generator disconnecting switches and oil circuit breaker. Determine by the use of the voltmeter plug whether potential is indicated on each phase of the generator potential transformers.

VI. Next insert the synchronizing plug. The pointer of the synchronism indicator should "jump" to the neutral (vertical upright) position and the synchronizing lamps be dark, provided that the synchronizing connections are correct. This is an absolute check, as both sets of potential transformers are energized from the same source.

VII. Should the synchronism indicator, on the insertion of the plug, take the vertical downward position and the lamps show bright, opposite polarity of the generating and bus potential transformers is indicated. In this event disconnect the bus potential transformer used for synchronizing and determine the polarity, additive or subtractive, as outlined by the Standardization Rules of the A. I. E. E. Determine also the polarity of the generator potential transformer used for synchronizing. These determinations will show the polarity of one potential transformer opposite to that of the other. The secondary leads of the generator potential transformer must be reversed and the test repeated. Results outlined in Section VI should now be obtained.

In case synchronizing is done between generators instead of generator to bus, substitute the following for Section VI. Insert running plug in the receptacle of any generator in service and starting plug in the receptacle of the new generator. Results identical with Section VI or VII will follow the insertion of the second synchronizing plug.

After the synchronizing connections have been proved correct, open the oil circuit breaker and disconnecting switches, reconnect the generator cables and insulate the joints, and the unit is in condition to be synchronized and placed in service.

Note—In certain types of synchronism indicator it is difficult to make the pointer stand at any other than the vertical upright position, Section IV. In this case, if synchronizing is done between machines, the pointer will tend to creep from the vertical upright position on the insertion of the first plug and will "jump" to the neutral position when the second plug is inserted. Similar results may be obtained where a six-point receptacle and one plug is used by inserting a bent wire jumper in one pair of holes of the synchronizing receptacle, causing the pointer to creep, then inserting a second jumper in the other pair of holes.

A. H. SWEETNAM,
Construction and Engineering Division.
Stone & Webster, Inc.,
Boston, Mass.

Starting 6,600-Volt Motor-Generator Without Compensator

DURING the war period of high production our power house became inadequate to carry the load and immediate relief had to be obtained. A motor-generator set was decided upon as being the quickest and most reliable unit inasmuch as our shop drive is 220 volts direct current and power is supplied from the United Illuminating Company at 6,600 volts alternating current. The only machine readily available was a 700-hp. motor-generator set consisting of a 6,600-volt synchronous motor directly connected to two 250-kw., 115-volt, three-wire generators. As no starting compensator could be purchased with this set, the machine was started from the direct-current end and the alternating-current machine was synchronized daily with the line. Since the delivery on all electrical material was exceedingly long, most of the starting apparatus was improvised and made from material at hand.

The direct-current connections are shown in Fig. 1, both armatures and both shunt fields being connected in series. A special change-over field switch was used, as shown in Fig. 3, to shift from separate excitation to self-excitation without breaking the field current. Care was used to make temporary connections as easily removable as possible so that a quick change-over could be effected when the alternating-current starting compensator arrived. A direct-current starting rheostat was made by connecting several resistance grids in parallel and using a three-pole, single-throw knife switch to short circuit these steps of resistance as the machine came up to speed. A rating of 400 amp. for two minutes was allowed. This switch was mounted with the reversing switch on the ammeter on a separate panel next to the main panel. As shown in Fig. 1, this resistance was simply connected across the line-switch lugs.

The ammeter reversing switch was used so that the current at starting and running could be read. The accuracy was slightly impaired, but since heavy loads were read the error was not appreciable. As the direct-current panel was one of several, one voltmeter and one voltmeter plug were used for all by making an eight-point receptacle of the same spacing as the standard four-point outfit. With this, the voltage across each machine and the two in series for paralleling could be read.

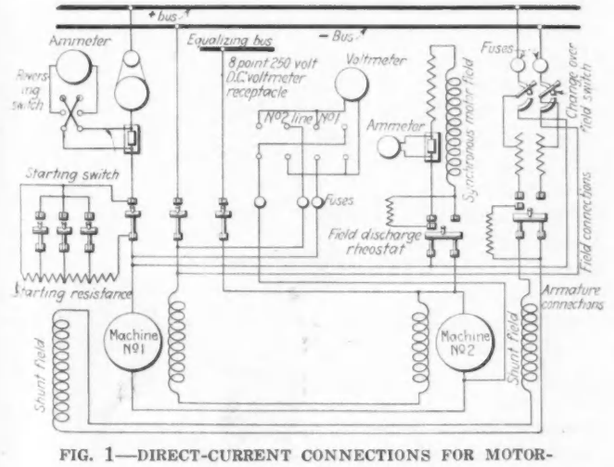


FIG. 1—DIRECT-CURRENT CONNECTIONS FOR MOTOR-GENERATOR SETS

The field of the synchronous motor was run at 115 volts and was connected across one armature. When the current in the armature reverses owing to the driving load being taken by the synchronous motor, the current in the field does not reverse, but remains steady, changing very slightly as the machine is put on the line.

The special direct-current machine field switch had to be used, because the direct-current machines must be separately excited at the start (running as motors), and if they were to remain so when the machine is running alone on the bus and the circuit breaker were to blow, the alternating-current machine would have its armature across the line without field excitation. After the machine is synchronized the operator throws these switches to the self-excited position. Fuses on a field circuit are bad practice, but heavy fuses were placed on the starting side because if the operator should pull both these switches at the same time the armature would be thrown across the line and produce a short circuit. The fuses were made extra-heavy, and as they were only used during starting no trouble was experienced.

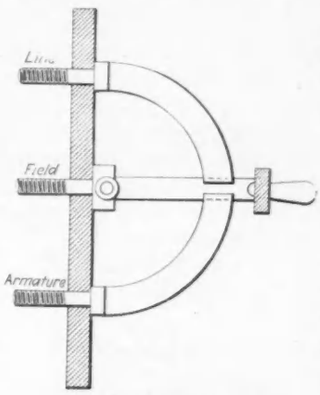


FIG. 3—CHANGE OVER FIELD SWITCH

The phasing and synchronizing connections on the alternating-current machine are shown in Fig. 2. No synchronizing receptacles or double-voltage transformers could be secured. A wooden panel was wired using a voltmeter, synchroscope, three-pole single-throw knife switch, two-pole double-throw knife switch, single-pole single-throw knife switch and four lamp receptacles, three with 110-volt lamps and one with a 220-volt lamp.

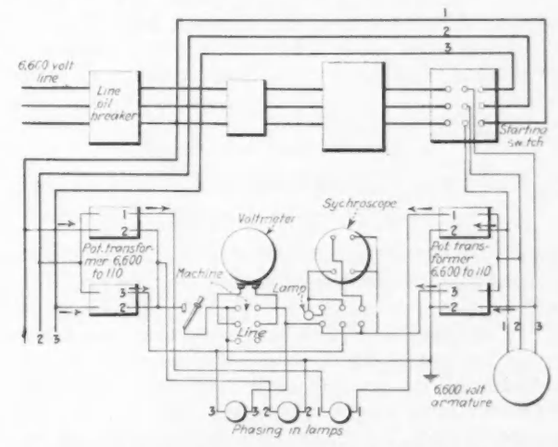


FIG. 2—SYNCHRONIZING CONNECTIONS FOR 6,600-VOLT MOTOR-GENERATOR SET

Four 6,600/110-volt potential transformers were used, extreme care being exercised to get the proper polarity or relation of instantaneous voltages. The arrows and figures show these directions and corresponding phases. This connection is equivalent to establishing two three-phase circuits similar to the primary circuit in all respects except voltage. All three lamps thus dim and brighten together when the phase rotation of the

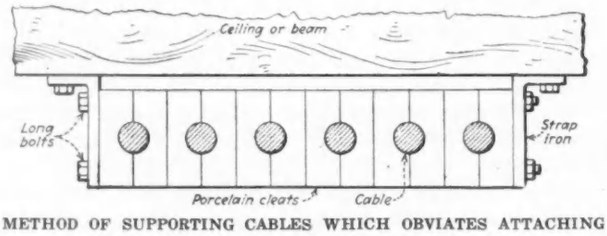
machine and the line is the same. The single-pole single-throw switch remains open when the lamps are being used and is kept closed afterward, otherwise one lamp would be short-circuited by the common connection to the ground. If the machine rotation is reversed as shown by individual flashing of the lamps, this can be easily corrected by reversing the alternating-current leads or the direct-current machine field leads. As soon as the correct rotation is established one potential transformer of each set can be removed, the single-pole single-throw switch permanently closed and the three lamps removed. It is well to check the lamps and synchroscope first, however. At the point of synchronism the starting switch was thrown in, the equalizer on the direct-current board and the direct-current armature voltage being raised until the required load was carried.

This machine was started in this manner for six months until the compensator was installed in the place provided. No accident of any sort occurred.

Bridgeport Brass Company, Bridgeport, Conn. H. Y. BLODGETT, Electrical Engineer.

Support for Several Cables

INSTEAD of using the ordinary straps or cleats put up in the ordinary manner for supporting several large cables on a ceiling or wall run, the writer assembles the cables between cleats as shown in the accompanying drawing. They are supported on long



METHOD OF SUPPORTING CABLES WHICH OBVIATES ATTACHING THEM BY INDIVIDUAL SUPPORTS TO CEILING

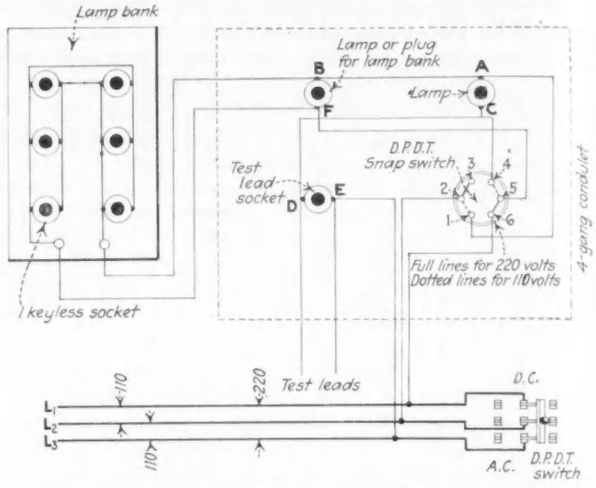
rods which are in turn run through iron straps bolted to the ceiling or wall. This makes a neat job and saves the time of fastening up a large number of straps or cleats.

W. A. HARRIS.

New York, N. Y.

Neat and Inexpensive Test Set for a Repair Bench

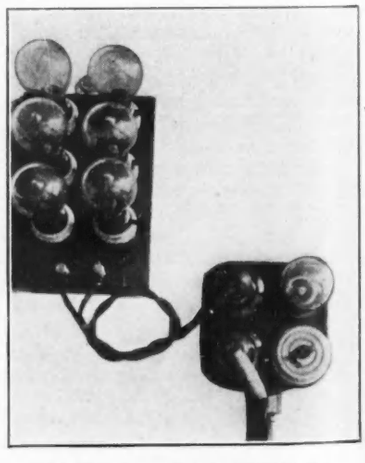
A BENCH test set suitable for testing commutators, making bar-to-bar tests and for other "lighting-out" purposes is shown in the accompanying illustrations. It consists of a switch, two resistance lamps and a plug receptacle for the test leads, all of which are embodied in a four-gang condulet. Several of these fixtures are mounted along the wall at the back of a bench. The system is made of standard conduit fittings, ½-in. conduit carrying three No. 14 rubber-covered wires from one section to the other, with T condulets inserted at each point where a fixture is required. The three wires run from a three-pole, double-throw switch which gives either alternating current or direct current of 110 and 220 volts. These wires feed into the fixtures. Each fixture is a Paiste horizontal four-gang, pipe taplet, type GGH, No. 4369, having three sockets No. 4257, with three covers No. 651, and one double-pole, double-throw snap switch No. 2623. The wires are fed in through one ¾-in. to ½-in. reducing bushing and one ½-in. T condulet. The snap switch is mounted in the lower corner of the fixture and in the two upper corners are screwed lamps. A receptacle for receiving the plug of the test leads is inserted in the lower left-hand



CONNECTIONS FOR COMPACT SET FOR TESTING WITH LAMPS IN SERIES ON 220 VOLTS AND 110 VOLTS

socket. In place of the upper left-hand lamp a plug may be inserted as shown, connected to an additional lamp bank of six lamps, which is hung on the wall near by. The lamp bank has five key sockets and one keyless socket, and the leads are inserted in the two binding posts as shown. By the use of one keyless socket there will always be one lamp in circuit on the lamp bank. Thus, when 220 volts is used, this lamp and the lamp in the fixture will always be in series. When the snap switch is in the position shown by the full lines, 110 volts is obtained on the last leads. When it is in the position shown by the dotted lines, 220 volts is on the leads, with the lamps, of course, in series.

Following out the circuits, it will be noticed that there is always one lamp in series on 110 volts and that any number up to seven lamps may be put in parallel. On 220 volts two lamps are always in series. If the lamp bank is connected to one of the sockets, there may be danger of impressing too high a voltage on the lamp in the condulet when 220 volts is being used. This is possible if the test leads are connected to a fairly low resistance and more than one lamp is turned on in the lamp bank in series with the one lamp which is in the condulet.



COMPACT TEST SET MOUNTED BACK OF REPAIR BENCH

Lamp bank may be removed by pulling out plug and a single lamp substituted.

It must be noted that one of the test leads is connected directly to the line, and therefore this line should be properly fused.

A. C. ROE.

Detroit, Mich.

Remedies for Troubles of Induction Motors

ALTHOUGH an induction motor is an exceedingly efficient and rugged piece of machinery, there are certain troubles which may develop. In the accompanying table is a list of symptoms of troubles together with their causes and the proper procedure for their elimination.

This information should be quite useful to the industrial plant's electrical department in determining the nature of troubles in the shortest time.

Provincial Paper Mills, Port Arthur, Ont.

H. E. STAFFORD, Electrical Engineer.

Troubles of Induction Motors and How to Remedy Them

	Symptom	Trouble	Cause	Remedy
1	Bearing too hot to touch, or smoking.	a. Bearing dry.	Not sufficient oil. Oil rings not working.	Refill with clean oil after first washing the bearing with kerosene.
		b. Bearing dirty.	Grit in oil.	Same as above.
		c. Bearing tight.	Cause 1 and 2 above, causing particles of metal to be sheared off and deposited at other parts.	Scrape bearing and shaft or replace bearing.
		d. Oil rings not working.	Rings out of slots.	Replace rings, making sure no metal adheres to sides of slot. If ring sticks or runs slowly, bevel it at either top or bottom with a fine file.
		e. Bearing binding.	Shaft out of true.	Place shaft in a lathe and true and renew bearing.
		f. Bearing out of true.	Too much strain on pulley.	Bearing should be shimmed with pieces of tin, as a temporary measure, or replaced with new bearing.
		g. Loose bearing.	Vibration.	Tighten set screws holding bearing in journal.
2	Bearing hot, but no hotter than other parts of motor.	Heat transferred from rotor or stator of motor.	Overload on motor.	Decrease load or increase size of motor.
3	Smoke issues from windings. Part of windings hot while remainder cool. Wedges over coils charred.	Displaced air gap or rotor not centered in stator.	Bearing worn on one side.	If noticed before coils are damaged, realigning the bearing and inserting new wedges will correct the fault; otherwise coils will need to be replaced.
4	Every second coil in a two-phase motor and every third coil in a three-phase motor hotter than adjacent coils.	a. Not enough resistance in phase which is hottest, causing unbalanced currents in phases.	One or more coils of one phase short-circuited within themselves.	Replace short-circuited coil or "jump" the coil* as a temporary expedient.
		b. One phase grounded.	Dampness or damage by foreign material.	Remove ground by lifting coil and reinsulating. One ground not serious if motor is not overloaded, when delta-connected. If star-connected, there may be unequal currents between phases. If two phases are grounded, a short circuit is the result.
5	Motor runs hot, and on examination it is found the groups of two-phases of a star-connected motor, and the groups of one-phase of a delta-connected motor are hotter than other groups.	Motor running single-phase.	One fuse blown or one overload relay out of order.	Replace fuse or adjust relay and take ammeter readings of each phase.
6	Motor runs hot and explosions, accompanied sometimes by fire, occur in windings.	Temporary ground or short circuit.	Due to dampness which causes circulating currents between coils and between any coil and ground.	a. Bake motor until all dampness disappears and dip or brush with insulating varnish. b. If coils are punctured, replace with new coils. c. If motor is needed at once, the punctured coils can be cut out, if not too many, as a temporary expedient.*
7	Motor runs hot with all stator coils the same temperature.	Motor usually overloaded.	Motor overloaded.	Test each phase with an ammeter, and if readings are high, reduce the load or increase the size of the motor.
8	One or more phases hot in spots, while cool in others.	Part of windings inoperative.	Short circuits between adjacent stator coils.	Replace short-circuited coils, as they will usually be found badly charred.
9	Motor refuses to start with starter handle in starting position, although the motor issues a humming sound.‡	a. Motor tries to run single-phase.	One fuse blown or one overload relay out of order.	Replace fuse or adjust relay.
		b. Air gap displaced.†	Bearing out of true.	Shim the bearing or replace with a new one.
		c. Open circuit in stator windings.	Caused either from a short circuit, which might puncture a coil or from rough handling.	Insert new coil or "jump" the damaged one.*
10	Motor starts and runs, but rotor heats up while the stator is cool.	Abnormal currents in rotor.	Rotor bars loose or grounded.	Tighten set screws holding rotor bars to short-circuiting rings and solder or weld them, and remove grounds. In the more up-to-date types of rotors having cast-on end rings, this trouble is seldom encountered.
11	Motor issues a peculiar sound when running light, as if a heavy load were thrown on periodically with a slight slackening of speed at these intervals.	One coil in one phase reversed.	Due to wrong connection when being repaired or reconnected.	Connect coil to its proper group and in proper polarity.
12	Motor issues a buzzing sound when fully loaded.	Loose connection on rotor bars.	Overheated bars or rings.	Same as for symptom No. 10.

* Care must be used in "jumping" a coil, and the following points should be observed: Where a phase-boundary coil is cut out or "jumped" care must be taken that no interconnection of phases or wrong groups takes place. In one-layer windings, if the insulation is badly burnt, the coil will have to be completely taken out, since, if only disconnected, circulating currents will be produced which will heat up the "jumped" coil and damage adjacent coils. This is due to there being only one coil side per slot. If more coils than one per phase are burnt, care must be taken that there are enough left to offer enough resistance to keep the current low on account of excess heating.

† Where the rotor is not centered in the stator, it is possible that a motor cannot develop sufficient torque, and consequently will not run, although all fuses are intact. The motor will hum and the rotor will probably turn an inch or so. The symptom is the same as that of a motor trying to run single-phase. In a case of this kind insert a feeler between the rotor and stator, and the trouble will show up as an irregular air gap.

‡ The following hints will be found useful in locating the trouble: If a motor does not start, (1) examine the fuses; (2) examine the relays; (3) look over the starter carefully as outlined in a previous article in the ELECTRICAL WORLD, Aug. 6, 1921, page 276; (4) inspect air gap with a feeler; (5) remove belt or coupling, as the case may be, to find if motor is overloaded; (6) test out motor windings with a magneto or bank of lamps. One of these suggestions should locate the trouble, and by applying the proper remedy the difficulty is soon solved.

Management and Policy

Embracing Central Station Commercial Organization and Management, Customer and Trade Relationships, Public and Financial Policies, Advertising, Selling and Service Methods

An Emergency Policy—"Pay as You Sell"

BY WILLIAM GOULD

Commercial Manager Massachusetts Lighting Companies, Boston, Mass.

THE imperative need of the electrical industry today is to break away from the present Micawber-like policy of "Waiting for something to turn up." It is my opinion that the "pay-as-you-buy" methods are doing much to retard the recovery of business and that what we need at this time is to adopt the plan of "pay-as-you-sell." This plan has very recently been put into effect among the ten gas and electric utilities under the management of the Massachusetts Lighting Companies interests. Manufacturers and jobbers are allowing us to pay for appliances as we later sell them, instead of buying outright in quantity of appliances or placing blanket contracts for the estimated seasonal requirements. The plan has been in use only a few weeks, but even this short trial shows conclusively that the sale of appliances is being strikingly increased. The plan is not a consignment method, but a straightforward attempt to concentrate sales activities upon products arranged in "mass formation" in the light of day, right in the salesroom, instead of being demobilized in the unfrequented recesses of the manufacturer's or the jobber's stockroom.

WILLIAM GOULD

By the "pay-as-you-sell" method the utility—and the contractor-dealer of approved credit and commercial qualifications—agrees to adopt a definite sales policy for the appliance, including a definite advertising, show-window and display space for it, backed by the united effort of the entire organization to get it into service. Instead of buying on a hand-to-mouth basis, with low production, heavily stocked warehouses and small volume of business, it means larger and more widely distributed buying by the public and by the sales organizations. It may mean the carrying of substantial stocks by the jobber in order to meet the demands of growing business, but it will mean a more rapid turnover for both the jobber and the retailer, and it will mean increased output for the manufacturer.

The electrical industry has been severely handicapped in the last few years by increasing costs of labor, material and capital. Manufacturers have also materially reduced their selling organizations, and a lack of life in selling campaigns and efforts is all too evident.

Successful appliance-selling campaigns can be revived if this large investment in money in hidden stocks can be liquidated by the "pay-as-you-sell" plan. Stocks of finished goods now "eating their heads off" in fixed charges in warehouses can be moved into the retail showroom and vigorously merchandised from quantities large enough really to impress the public. Convenient payments, under the installment principle, can be utilized as hitherto between the ultimate purchaser and the retailer. Cash payment, however, will prove a big factor. The desire to complete partial payments long before the term of the agreement is up closes probably 60 per cent of such accounts. The public utility can therefore well afford to make the full payment to the jobber or manufacturer upon recording the ultimate sale.

This plan will make it easier for many small companies to enter actively into the merchandising field and will aid in teaching them how to sell goods. It will result in the creation of many new selling agencies in hitherto inactive quarters and without the heavy initial investment usually required.

Before-the-war methods of financing are changing to meet present conditions, and a small customer who buys regularly is proving better than a big one who buys intermittently. The new plan may not be needed in normal times, when industries are running at full speed, but it has worked well in the sale of lamps and it offers a way to remove the present barrier to selling activity. It will bring large and small companies and concerns into step for better times and create new revenue for every branch of the industry.

Utilities Must Advance, Says Nova Scotia Board of Commissioners

"A PUBLIC utility cannot stand still; it must either advance or go backward," says the annual report of the Board of Commissioners of Public Utilities of Nova Scotia. "To advance it must procure capital cheaply or on fair terms in order to finance its undertaking and meet demands for larger and better service. Clamor against public service corporations undoubtedly makes this financing more difficult and will continue to do so until the public or the customer of the utility comes to realize that it reacts upon the customers and has the effect of causing the man with capital to look askance upon public utility investments and securities. The more unattractive the investment is made to appear the greater the inducement or premium which has to be offered. Such increased premium must sooner or later be reflected in rates, and ultimately the constituency which by its hostility and criticism made the securities of the utility unattractive to the investor is itself called upon to pay either by submitting to service incomplete and unsatisfactory if capital expenditures are not made or in the increased outlay or premium for capital obtained and expended."

Omaha Electrical Family Launches Strong House-Wiring Campaign

SUCCESS in a house-wiring campaign depends more on preparation than any one other thing, in the opinion of W. S. Byrne, sales manager of the Nebraska Power Company of Omaha. Before launching the house-wiring drive there, now in full swing, a survey was made of the entire city and a new list built up totaling 4,500 unwired houses. Through the good relations existing between the central-station company and the telephone company it was possible to develop direct from the file of the telephone company 2,500 selected names of homes using a telephone but not electric light.

"We then went to the electrical contractors of Omaha through their organization," says Mr. Byrne, "and pointed out that there was in the neighborhood of $600,000 worth of wiring business available in the territory. A number of them agreed to participate in a direct mail and house-to-house solicitation of this business based on a unit cost per outlet for the wiring.

"The campaign is quite too young to give a definite estimate of the results, but we are most optimistic from the returns of the first three days of the canvass. Postal cards and first letters, which, by the way, carried an actual sample of wire, were sent out to 176 'prospects' and were followed by calls by the contractors' representatives on 116 of them. Eleven contracts were immediately obtained, and sixty-two were, in the opinion of the salesman, 'live prospects' whom they believed could be persuaded to wire within a very short time."

Boston Lighting Bureau Aids Equipment Sales

PURCHASES of industrial lighting equipment have been stimulated in New England by the exhibit of the Bureau for Better Illumination at 491 Boylston Street, Boston, according to a preliminary statement by J. Daniels of the engineering department. As recently outlined in the ELECTRICAL WORLD, this exhibit is being maintained by co-operating representatives of all branches of the electrical industry, and in the four months of its service sixteen major meetings have been held, besides a number of private meetings. More than 600 persons have examined the display, which is declared on good authority to be the most complete thus far assembled in the country. During the summer visitors from the electrical industry predominated, but steps are now being taken to bring manufacturers to the exhibit, and with good results.

Following a visit of fourteen executives to the exhibit, the American Printing Company, Fall River, Mass., purchased several thousand dollars worth of improved lighting apparatus. The Mead-Morrison Company, East Boston; Gillette Safety Razor Company, South Boston; Farrington Manufacturing Company, Roxbury, and Security Mills, Newton, Mass., are a few of the local factories which are making or have made changes as a result of viewing the display. Other betterment work is reported from Revere, Salem and Lowell, Mass., Manchester, N. H., and Providence, R. I. During "No Accident Week," when the tenth annual congress of the National Safety Council was held at Boston, representatives from various manufacturing companies demonstrated the exhibit to attending visitors, the display being kept open day and night. Mr. Daniels states that so far not a single visitor has failed to state definitely that he is "sold" on the idea of good lighting as a result of seeing the exhibit.

Picture of Minneapolis Company's Growth Helps Sell Stock

THIS customer-ownership window display of the Minneapolis General Electric Company bears out the old saying that nothing succeeds like success. On a map of the company's territory different-colored tacks are inserted representing the number of stockholders, customers and towns served. Below the map is a record of the company's growth telling how in the period from 1912 to 1921 the towns served have increased from 36 to 290, the customers served from 48,000 to 151,000, the connected load from 92,000 hp. to 359,000 hp. and the shareholders from 2,000 to 16,000. This constant growth of business and the evidence of confidence shown by the increase in shareholders stimulated numerous inquiries from prospective stockholders. T. C. Erringer,

CONVINCING CUSTOMER-OWNERSHIP WINDOW DISPLAY OF MINNEAPOLIS COMPANY

manager of the company's securities department, says: "The display attracted a great deal of attention and brought many callers into the office, resulting in quite a few sales. It is beyond doubt one of the most effective window exhibits we have had."

"Airplane Movie" of Utility's Property to Boost Customer Ownership

BELIEVING that stock can be sold more readily to an investor when he is familiar with the physical property of the industry in which he is asked to become a partner, the Northwestern Electric Company of Portland, Ore., is preparing an "Airplane movie" for use in its stock-selling campaign. This exhibition will give a graphic picture of the company's property to prospective stockholders. It will consist of a series of motion pictures of the company's hydro-electric development, power plants and transmission lines taken from an airplane.

Flights are now being made in the mountains and along the White Salmon River in Washington in the vicinity of the company's hydro-electric plant. A motion-picture operator is filming scenes of the mountainous country and along the river, showing where its power is converted into electric energy and then carried over transmission lines to the many consumers in Portland. The pictures will be exhibited at local motion-picture theaters in Portland and be an excellent means of stimulating interest in the company's preferred stock.

Small Company Sells Fifty-eight Washing Machines in Ten Days

TO SELL fifty-eight washing machines in ten days in a community with 2,500 residence customers, one-fourth of whom live in a district just then emerging from a six months' strike, about 800 residing in an industrial section where the factories were operating only three or four days a week, and the remainder being farmers at the height of the crop season, was the achievement of the Northern Connecticut Light & Power Company, Thompsonville, Conn. This was accomplished by newspaper and direct-mail advertising of machines obtained from an overstocked distributer and offered at a reduction of $60.25 from the former price of $160. Both the installment and the cash-payment plans were used. Twelve of the thirty homes represented by electrical department employees are users of electric washers. Walter P. Schwabe is general manager and John A. Ryan is in charge of the merchandise and new-business department of the company. The department consists of three people, a manager, one clerk in the appliance store and one outside salesman.

Temporary Floodlighting Installation Profitable in Two Ways

PROFITABLE business and public good will can frequently be secured by central-station companies from temporary lighting loads. An interesting example comes from the Louisville (Ky.) Gas & Electric Company in the floodlighting of the new Merchants and Manufacturers' Building at the Kentucky State Fair grounds. This was the first large floodlighting job in Louisville, and as the building is now the largest in the state it attracted a great deal of attention and much interested comment. More than 200,000 persons visited the building during the fair. The entire lighting for the state fair, held recently, was furnished by the Louisville company. The demand was between 500 kw. and 600 kw. and was used about five hours a night for the week.

The floodlighting equipment was designed and installed under the supervision of George M. Miller, superintendent of the electrical construction and distribution department of the Louisville Gas & Electric Company.

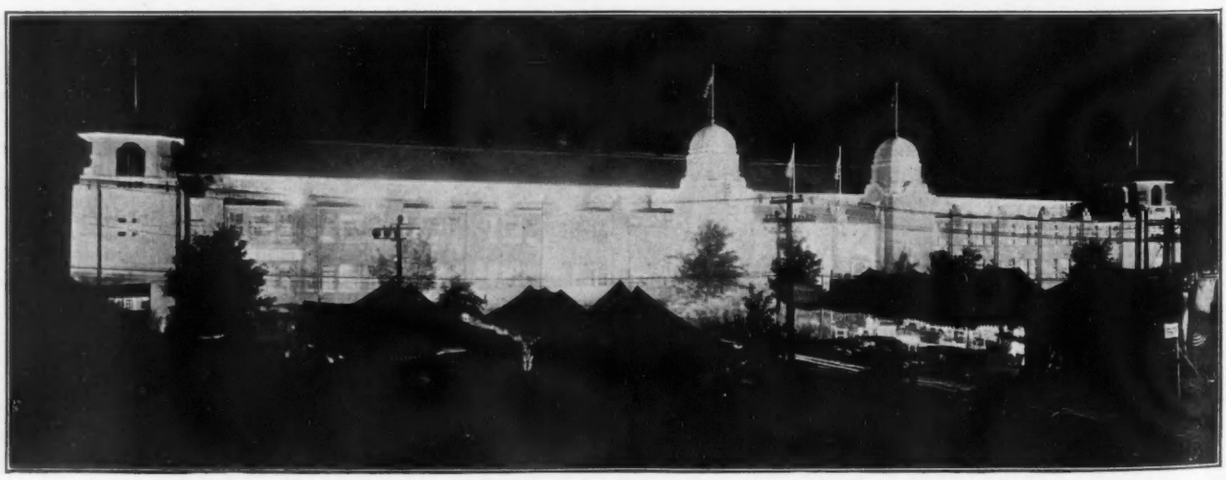
What Other Companies Are Doing

San Diego, Cal. — Business of the San Diego Consolidated Gas & Electric Company has expanded so rapidly that an addition to its power plant will be built to house a new 15,000-kw. turbine. Even with the additional capacity provided by the purchase of the street-railway company's generating station last winter, available power is no longer adequate to meet the demands upon the company for service.

Pasco, Wash.—The Pasco branch of the Pacific Power & Light Company recently held a successful "Dollar Day" sale at which some very special bargains were offered in the way of old-stock lighting glassware. R. B. Bragg in writing of the sale says: "We recommend this means to any company that is still carrying on its books stocks left from ill-advised purchases several years ago. This sale left us with only four shades on our hands, and one customer paid us a dollar for two of them to use for hanging baskets."

San Francisco, Cal. — Merchandise sales of the Pacific Gas & Electric Company and the Great Western Power Company, serving the territory in and around San Francisco, have been limited almost exclusively to electric ranges, small appliances being left entirely to dealers. The Pacific Gas & Electric Company thus far this year has sold 250 ranges and the Great Western Power Company 177, principally during the last two or three months. At the present rate, under an intensive campaign for the sale of ranges, they expect to sell 175 to 200 more before the close of the year. The Pacific Gas & Electric Company has also sold 175 water heaters.

Providence, R. I.—The Narragansett Electric Lighting Company maintained its total appliance sales in dollars within 5 per cent of last year's record for the first six months of 1921 compared with the corresponding period of 1920. For the first five months of 1921 the total was 98.7 per cent of the January-May figures a year ago. Such figures are heartening indeed, A. H. Alcott, manager of the merchandise sales department, points out, when one considers the shrinkage in prices recently experienced by the trade and the disposal of 1919 left-over stock purchased on a rising market. To June 1 this year the lamp sales of the company exceeded the sales of the corresponding 1920 period by 8.2 per cent.



FLOODLIGHTING OF MERCHANTS AND MANUFACTURERS' BUILDING AT KENTUCKY STATE FAIR

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Controllers for Direct-Current Motors.—W. J. JOHN.—Advantages and disadvantages of the face-plate type, the drum type and the contactor type of controllers are given. Relative costs are shown in the accompanying table.—*Beama* (British Electrical and Allied Manufacturers' Association), September, 1921.

Circle Diagrams for Closed Slots.—H. P. WHITEHORN.—A test of a 20-hp. motor with closed slots to bring out the difference between them and semi-closed slots in three-phase induction motors. The most important effect of a complete bridge on the slot is a decrease in the power factor which is equivalent to a displacement of the center of the circle diagram below the base line by an amount depending upon the thickness of the bridge.—London *Electrician*, Sept. 16, 1921.

Lamps and Lighting

Lighting the Modern Cannery.—WARREN ALDEN.—Proper illumination as a factor in increasing production in the canning industry is described in this paper. Gas-filled lamps rated at 220 volts in RLM reflectors are the choice for some of the installations mentioned.—*Journal of Electricity and Western Industry*, Aug. 15, 1921.

Specifications for Large Incandescent Lamps.—For the fiscal year that began on July 1, 1921, new specifications were adopted which include important changes in the test procedure for tungsten lamps. The most notable of these changes is the abandonment of the long-established provision that the life of test lamps shall be considered as ended when the candlepower has fallen to 80 per cent of the initial value. The specification of such an end point is convenient and reasonable in the testing of carbon lamps, because those lamps will often burn for a long period after they have become so blackened that they should not be continued in use. In tungsten lamps, however, means have been found to prevent excessive blackening of the bulbs, so that the lamps normally burn out before their efficiency has fallen enough to justify replacing them. The new tests will therefore be based on the total life to the time of burnout, thus conforming more nearly to actual practice in the use of lamps.—*Circular 13, Bureau of Standards* (ninth edition).

Generation, Transmission and Distribution

Condensation in Turbine Rooms.—L. J. TOWNE.—Information on this subject indicates that condensation difficulties will be eliminated or minimized by (1) providing an inclosed ventilated air space below the roof slab; (2) insulation of the roof slab by some non-conductor of heat; (3) reducing steam leakage to a minimum; (4) providing wall radiation for large exposed wall and window surfaces; (5) adjusting the generator air-cooling system to maintain a positive pressure in the building in connection with natural ventilation; (6) providing an independent heating and ventilating system for the turbine room itself, when a self-contained generator cooling system is used.—*Stone & Webster Journal*, September, 1921.

Ground Current in Theory and Practice.—L. LICHTENSTEIN.—The paper contains mathematical derivations of formulas for the determination of the distribution and magnitude of currents traveling through the ground, such, for example, as those between steel towers with faulty insulators.—*Elektrotechnische Zeitschrift*, Aug. 4, 1921.

Electrical Transmission Versus Coal Transportation.—HAROLD W. SMITH.—**An analysis is made of the cost of transmitting large amounts of energy from coal-mine districts to industrial centers, and these costs are compared with the cost of shipping coal.—*Electric Journal*, September, 1921.**

Water-Power Resources of Canada.—A compilation of the available and developed water power in Canada. The figures in the accompanying table are based on known data and do not include the power of many unsurveyed falls.—London *Engineer*, Sept. 2, 1921.

AVAILABLE AND DEVELOPED WATER POWER IN CANADA

Province	Available Twenty-four-Hour Power at 80 per Cent Efficiency At Ordinary Minimum Flow, Hp.	At Estimated Flow for Maximum Development Hp.*	Turbine Installation, Hp.
British Columbia	1,931,142	5,103,460	304,535
Alberta	475,281	1,137,505	32,492
Saskatchewan	513,481	1,087,756	.....
Manitoba	3,270,491	5,769,444	83,447
Ontario	4,950,300	6,808,190	1,052,048
Quebec	6,915,244	11,640,052	925,972
New Brunswick	50,406	120,807	21,180
Nova Scotia	20,751	128,264	35,774
Prince Edward Island	3,000	5,270	1,933
Yukon and Northwest Territories	125,220	275,250	13,199
Total	18,255,316	32,075,998	2,470,580

*Dependable for six months

Traction

Electric Traction in Switzerland.—A review of the development of electrification since the war on some important sections of the Swiss railways. Descriptions of the engines, substations and other equipment are given.—London *Electrician*, Sept. 9, 1921.

Giornico Substation of the Swiss Federal Railways.—C. COHEN.—**This is one of two substations feeding the Gotthard tunnel line with single-phase current at 16⅔ cycles and 15,000 volts from the 60,000-volt trunk line from the Ritom power house. The station contains two 5,000-kva., single-phase, 16⅔-cycle transformers, with room for a third unit. The machines are oil-cooled, the oil for each transformer being circulated by electrically driven centrifugal pumps and forced through two coolers. The design of the coolers is identical with that of the "BBC" surface condenser as used in steam practice. An oil filtering and boiling system is permanently installed and connected to the transformers. The substation serves solely for the supply of the railway.—*Brown-Boveri Mitteilungen*, September, 1921.**

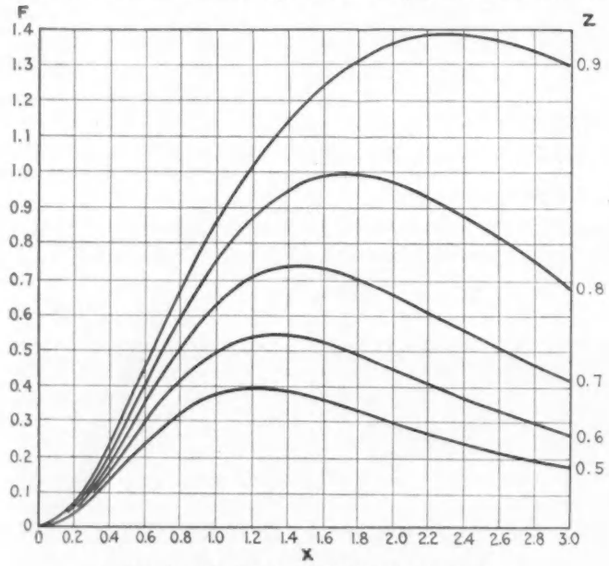
Automatic Safety Apparatus for Train Control.—M. GOUINEAU.—The Regan automatic train-blocking system, used in America on the Chicago, Rock Island & Pacific line, has been slightly modified and adapted to French railway service. It is in very successful operation on the Paris-Dieppe branch. Photos, drawings and connection diagrams accompany the paper.—*Revue Générale de l'Electricité,* Sept. 24, 1921.

Installations, Systems and Appliances

Electrical Auxiliary Machinery for Ships.—S. E. GLENDENNING.—Points to consider in the design and manufacturing of auxiliary electric machinery for use on a ship are enumerated. It is stated that direct current at 220 volts holds the field as standard practice. Ventilation of machines on ships must be especially provided for, and the machinery must be as light as possible, especially that located on the upper decks. One of the most important installations on board a ship is that of fans. Often these are arranged for several speeds. Electrically driven deck winches form a very large part of the auxiliary equipment. In all electrical equipment on shipboard special attention must be given to insulation, and nothing that will not stand 2,000 volts alternating current should be allowed. Careful attention must be paid to painting and enameling metal parts of motors; aluminum must not be used on account of corrosive effects of salt water.—London *Electrician,* July 29, 1921.

Electrophysics and Magnetism

The Effect of the Short-Circuit Winding in Alternating-Current Electromagnet.—L. DREYFUS.—The author examines in detail the field conditions in an alternating-current magnet where part of the core is surrounded by a short-circuited metal frame (damper) in order to obtain a time lag in the magnetic induction of



RATIO OF MINIMUM PULL WITH DAMPER TO AVERAGE PULL WITHOUT DAMPER

this part of the core. The results are shown in a number of curves, one of which is reproduced here. F is the ratio of minimum pull with damper to the average pull without damper. X is the ratio of resistance to leakage reactance for the short-circuited frame, and Z is a parameter $= v^2 f(2a/b)$, where a is the breadth of that part of the core which is surrounded by the frame, and b the total core breadth, while f is a correction factor, depending on the induction, and v is the ratio of quadratic average to arithmetic average of core induction within the damper frame. The value of f is about 0.95 and v is very nearly 1 in ordinary cases. The curves show that a/b should be taken rather high; that is, the damper should surround almost the entire core cross-section. It is interesting to note that for $a/b = 0.8$ a maximum value of $F = 1$ may be obtained; *i.e.*, the damper is increasing the pull so that minimum pull with damper equals average pull without damper. It is very important, however, that a proper resistance ratio X be chosen, and in certain cases it may be advantageous to use an open frame and external rheostat.—*Teknisk Tidskrift, Electroteknik,* June, 1921.

Electrochemistry and Batteries

Electric Furnaces in Laboratory Types.—EZER GRIFFITHS.—A description of the arc, induction, high-frequency-induction, vacuum-cathode-ray and other furnaces.—*Beama* (British Electrical and Allied Manufacturers' Association), September, 1921.

Resistance Type of Electric Furnace in the Melting of Brass and Other Non-Ferrous Metals.—T. F. BAILY.—The various features to be considered in making an electric furnace installation for melting non-ferrous metals are discussed.—Paper presented before American Electrochemical Society, Sept. 30, 1921.

Electric Furnace Melting of Nickel-Silver.—F. C. THOMPSON.—Advantages of melting nickel-silver in the externally heated electric furnace are discussed.—Paper presented before American Electrochemical Society, Sept. 30, 1921.

Units, Measurements and Instruments

Developments in Power-Station Meters.—A description of British instruments used for measuring steam, flue gas and other temperatures. The method of employing these instruments for increasing economies in generating plants is discussed.—London *Engineer,* Sept. 16, 1921.

Direct-Reading Wave Meter.—H. THURN.—A new wave meter, based upon the dynamometric principle, is described in detail, its function is explained, and several exterior and interior views of it are shown. The instrument can be used with proper shunts for the widest range of wave lengths. It is manufactured by the C. Lorenz company of Berlin.—*Jahrbuch der Drahtlosen Telegraphie und Telephonie,* August, 1921.

Telegraphy, Telephony and Signals

Testing Thermionic Valves.—H. J. LUCSA.—With multistage amplifier and transmitter sets a considerable degree of uniformity in the valve employed is required. This article describes tests which may be made to determine the characteristics of valves which are to be used together.—London *Electrician,* Sept. 30, 1921.

Frequency Meter of Telephonic Range.—A. E. KENNELLY and C. MANNEBACK.—An instrument which is easily constructed and enables quick measurements to be made, with the consumption of little power and a large range of frequency, is described in this paper. This meter consists of a fine steel wire fastened at one end to the top of a cathetometer and soldered at the other end to a known weight. The wire is supported in front of a telephone electromagnet energized by the alternating current whose frequency is to be determined. This instrument measures frequency ranging from 250 to 1,750 cycles per second.—*Journal of Franklin Institute,* September, 1921.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Definite Progress Being Made in Ford Negotiations for Muscle Shoals

FOLLOWING a conference in Washington on Oct. 24 between the Secretary of War, the Secretary of Commerce, Brig.-Gen. Harry Taylor, W. B. Mayo and Col. J. W. Worthington, Secretary Weeks declared that definite progress is being made and that the divergence between the estimates of the army engineers and the Ford engineers on the cost of the completion of the Wilson Dam and the construction of Dam No. 3 has been narrowed materially. Secretary Weeks stated that no bargaining was attempted at this conference as that will be done between Mr. Ford and himself soon after he has looked over the project personally, but his attitude indicated plainly that he is much more favorably impressed with the proposition in its present form than at any previous time.

Secretary Weeks left Washington Oct. 25 on a Southern trip and expected to spend Friday in a personal inspection of the Wilson Dam and the nitrate plants. He will return to Washington Oct. 30 and expects to "get down to figures" with Mr. Ford a few days thereafter.

Secretary Weeks took pains to point out that a portion of the difference between the estimates of the cost of completing the Wilson Dam and the construction of Dam No. 3 can be accounted for by the difference in costs at the times the estimates were made and by the fact that the army estimates cover a better type of construction than is absolutely necessary. He said that there is the greatest eagerness on the part of contractors to undertake work at this time and that, as a result, very advantageous arrangements can be made.

Although Secretary Weeks agreed that the reopening of the work would put smoke in many chimneys and would help the employment situation, he said that he could not agree with statements attributed to Mr. Ford as to the extent that active work on this project will stimulate industry.

National Parks Association Protests Against the Walsh Bill

A BILL to dam Yellowstone Lake introduced into the United States Senate by Senator Walsh of Montana is characterized by the National Parks Association as "perhaps the most dangerous blow ever aimed at American conservation." The association is at this time sending out literature urging readers to insist that their senators and representatives in Congress "soundly defeat the Walsh bill." A further extract from the statement is as follows: "If Congress grants one single irrigation privilege in any national park, no matter how inconspicuous the dam or how little it injures the park, it destroys the historic principle of complete conservation which alone differentiates national parks from national forests. It opens the door. Entire commercialization of all national parks logically and inevitably will follow the passage of the Walsh bill."

Ohio Utility Valuations Increased

THE Tax Commission of Ohio has boosted the valuations of Ohio utilities until the gain for 1921 over 1920 is two and one-half times the gain of 1920 over 1919. The increase is 8.2 per cent over 1920. Electric light and power companies received the biggest increase, the total valuation being $93,285,450, an increase of $15,187,530 over the 1920 figures. This represents an increase of 19.4 per cent as against an increase of 8.5 per cent for the telephone companies and 5.8 per cent for the natural-gas companies. Electric railways received the smallest increase in percentage, with a figure of 5.3 per cent. In addition to the taxes on this valuation the companies must pay a state excise tax of 1.2 per cent on gross receipts and the federal taxes.

Stockholders of Pacific Gas & Electric Company Told Company's Plan

THE Pacific Gas & Electric Company has held the first of a series of twenty or twenty-five stockholders' meetings which are planned for various locations in that company's territory. The first meeting was held in San Francisco and was attended by 500 stockholders who were told of the general plans of the company. The meeting was addressed by W. E. Creed, president, J. A. Britton, vice-president and general manager, and A. F. Hockenbeamer, vice-president and treasurer, who explained in detail the policy and program of power development. Mr. Creed opened the meeting and said in part:

"This meeting marks a pioneer movement in corporate management. The Pacific Gas & Electric Company is holding a series of meetings of its stockholders in various sections of the state for the purpose of acquainting them directly with the conditions and progress of the company and its function in the development of the state and in service to its people.

"In 1912 the State of California adopted a policy of state regulation of public utilities, and under that policy an unprecedented growth has followed. The state has grown not only in population but both industrially and agriculturally, and this growth has followed the growth of the Pacific Gas & Electric Company and other utilities. An idea of the extent of the growth of the public utilities can be gained from the fact that since the establishment of state regulation about a billion dollars has been invested in the public service industries in the state.

"The financial structure of the Pacific Gas & Electric Company is sound and conservative. The construction program of the company is based solely upon the needs of the state for gas and electricity and is adequate to

meet those needs as far as they can now be ascertained. The estimate of future demands is deemed to be a conservative one and the 'service' ideal of the company requires that the program be carried out. Close analysis of the gas and power demands of the present and the future indicates that the increased facilities are fully justified and will insure for the company a return upon the investment made to provide them."

J. A. Britton outlined the ten-year program of electricity and gas development which the Pacific Gas & Electric Company has before it today. He said the stockholders were entitled to know what the company was doing and why it was found necessary to spend an enormous amount of money during the next few years.

Mr. Hockenbeamer said that hundreds of millions of dollars would have to be raised in order to meet the demand for power that must surely grow proportionately to the constant growing developments in industrial and agricultural activities, to say nothing of population. He told of the methods and cost of raising money and other matters concerning the company's finances of which the public generally has but a vague knowledge.

More Licenses and Permits Are Issued by Federal Power Commission

A LICENSE to extend for fifty years has been granted by the Federal Power Commission to the Southern Sierras Power Company of Riverside, Cal. The license covers a transmission line and appurtenant structures in the Angeles National Forest. It requires that construction work must begin before Jan. 1 next and be completed before Jan. 1, 1923. In connection with the granting of this license it was stated that James Hulne, W. E. McKinnon and Albert Piepenburg relinquished all their rights of prior application in view of an arrangement whereby the power company will serve their mining operations.

A preliminary permit to extend for two years was granted the Connecticut River Company of Windsor Locks, Conn., covering a power project at the Enfield Rapids of the Connecticut River. A condition of the permit was that the company must collect stream gage and flow records of the Connecticut, Chicopee and Westfield Rivers and so design its works as to utilize to best advantage the flow of the Connecticut River without undue interference with other interests. A conflicting application by A. P. Connor of Springfield, Mass., was rejected.

A preliminary permit to extend for two years was granted to the town of Petersburg, Alaska, covering a power project on Crystal Lake in the Tongass National Forest. The power is intended for public utility use. A license was applied for, but owing to uncertainty as to when the proposition could be financed the commission granted a preliminary permit only.

A two-year preliminary permit was granted to Charles B. Hawley of Washington, D. C., covering a power project on New River at Sandstone Falls, Raleigh and Summers Counties, West Va.

Applications were received by the Federal Power Commission during the week ended Oct. 15 as follows, the name and address of the applicant, the type of application, a brief description of the project, the proposed use and the horsepower involved being shown:

J. G. Galvin, 620 Alaska Building, Seattle, Wash.; preliminary permit; power project involving the erection of a 100-ft. dam and a power house on Aaron's Creek on the mainland east of Wrangel Island; pulp and paper manufacture; power capacity, 10,000 hp.; installed capacity, 12,500 hp.

Southern California Edison Company, Los Angeles; preliminary permit; dam and power house in Boulder Canyon, dam and power house in Pyramid Canyon, Colorado River, Mohave County, Ariz., and Clark County, Nev.; public utility; power capacity, 900,000 hp.; installed capacity, 1,200,000 hp. (This application is in conflict with the application of Edward L. Bayard of Seligman, Ariz., and with the application of the City of Los Angeles.)

Mitchell Terzich, Sonora, Cal.; license; diversion of water from Eagle Creek through a flume to develop 8 hp.; house lighting.

Commissioner Favors "Public Financing" to Obviate Excessive Rates

SPEAKING to his fellow commissioners and the members of the commission staff recently, Chester H. Rowell of the California Railroad Commission declared that "regulation will survive only if it can continue to protect the public against extortion and exploitation and at the same time keep the utilities able to render their service and finance themselves to expand that service." Public ownership, Mr. Rowell declared, was the only alternative of regulation, and he recognized the unfitness for this responsibility of governmental bodies as at present constituted.

While there are still many problems in public service regulation, the basic principles of rate fixing are well established, Mr. Rowell said. He went on to assert that a fair return is one computed on a property and not an investment basis. In discussing the contention of many utilities that financial needs should be the basis for return, the speaker objected that this might lead to sustaining private financing even after the cost of that financing has become so great that the proper remedy lies not in still higher rates but in public financing. In explanation of this he instanced the case of the Spring Valley Water Company in San Francisco, saying:

"San Francisco will soon need more water than the present Spring Valley plant can supply and will need it before it can be supplied from Hetch-Hetchy or the municipal plant. But Spring Valley, under existing conditions cannot finance the necessary additional investment except at a cost which would necessitate rates unfairly high to consumers. The obvious remedy is, of course, for the city to take over the existing plants and finance the additions and refund the present financing at the cheaper rates which the city can obtain."

Moderate Improvement in Business Persists, A. W. Douglas Says

PERSISTING improvement, though of a moderate character, in business conditions in nearly all sections of the country is seen by Archer Wall Douglas, chairman of the committee of statistics and standards of the Chamber of Commerce, whose views are expressed monthly in *The Nation's Business*.

Such change as is apparent in industrial life generally is rather for the better, Mr. Douglas asserts. Textiles are in fair shape and leather maintains both its demand and appreciation in prices. There is some increase in the output in steel and iron products, but the recent rise in prices may not last. There is better demand for lumber at somewhat higher figures. The belief is general that next spring will usher in renewed construction activity.

Electrical Industry Prepared to Meet Railroad Strike

LITTLE or no worry is being indulged in by the electrical industry over the possible railroad strike. The utilities have laid in their winter surplus of fuel, and the trade feels that there is enough local stock to take care of demand so long as the strike lasts. The general feeling, however, seems to be that there will be no strike. A canvass of the situation was made this week by the ELECTRICAL WORLD.

NEW ENGLAND AND MIDDLE ATLANTIC STATES

Electric utilities and industries in New England face the threatened railroad strike with utmost confidence in their ability to maintain supply of energy to the public and to furnish the trade with necessary products. The opinion is widespread that no general tie-up of railroad transportation is likely. James J. Storrow of Boston, who was fuel administrator for New England during the world war, estimates that from six to eight weeks' coal supply is stocked in New England. Only where local hydro-electric plants of smaller size have been hard hit by protracted drought does there appear cause for anxiety, and it is probable that relief can be had in these cases through cooperative effort. Many central-station companies are supplied with enough coal or fuel oil to carry them well beyond the maximum probable duration of a strike. The falling off of power loads in central New England because of the now receding business depression has not yet been overcome, and this reduces the immediate demand for fuel by perhaps 25 or 30 per cent. If a strike comes, interconnection of electric systems will win fresh laurels through skillful handling of loads where unbalanced fuel conditions temporarily exist.

Electrical jobbers are not worrying so far as the ELECTRICAL WORLD can find out. Stocks are still large enough in most lines to meet several weeks' requirements, especially if supplemented by rush shipments by motor truck or trolley express from New England factories and by water from New York and New Jersey districts. Manufacturers of electrical products in New England are ready to meet the situation, having plentiful stocks of raw material in the main.

In the Middle Atlantic States there was no evidences of worry. Coal stocks are ample and in one instance run up a four months' supply. Besides, most of the larger stations are situated on the water and are by no means dependent upon rail transportation.

Jobbers' stocks are ample and none have been stocking up in anticipation of a tie-up, nor have dealers been making any unusual demands on the jobbers.

INDIFFERENCE IN THE MIDDLE WEST

Indifference marks the attitude of the Middle West toward the strike situation to an astonishing extent. Whether this is due to an expectation that the strike will not materialize, or if it does will not be serious, is hard to determine, but the general talk seems to indicate a belief that there is a great deal of bluffing being indulged in on both sides and a possibility that government action will force an abandonment of the strike. The central stations of the Middle West are in a favorable position as to fuel, especially the larger ones. Storage against winter contingencies is at least normal and in most cases above normal.

The larger utilities have storage that can carry them for thirty to ninety days at full load. In most cases no difficulty is expected from a complete shutdown until after the middle of December or the first of January, and in one or two cases until the first of February. The utilities in Kansas and Oklahoma close to the oil fields will suffer least of all, as most of those depending on oil are also equipped to use gas, which is piped directly into the plants. The smaller plants in the parts remote from oil supplies depend on coal and normally carry somewhat less than a month's supply ahead. They will probably begin to suffer in two to three weeks. This holds generally true all over the Middle West, though one Nebraska operator in close touch with the situation asserts that the small utilities in that state will not suffer until after the midddle of December. The same authority expresses a hope that a complete showdown will come and the trouble be settled for good and all.

It is probable that a real strike causing a complete shutdown would so reduce the industrial and other loads of consumers that many of the utilities would be able to operate longer than the above figures indicate because of reduced demands. Utilities close to the lake port storages in the Northwest and along the western side of Lake Michigan are favored to some extent by their proximity to supplies that in emergencies can be handled without rail hauls. The situation in Ohio and Indiana seems to be about the same as in the territory farther West. One peculiar feature of the situation is the reports in Chicago Wednesday morning that indicate an actual drop in the demand for coal and seem to indicate no fear on the part of the buyers that there is any real emergency ahead. Dealers attribute the slump to the warm weather occurring the early part of the week.

Jobbers and dealers generally take the attitude that there will be no strike, and as stocks are rather generally on a thirty-day to sixty-day basis and the demand is below normal there is nothing to worry about at present. In Chicago the supplies to retailers near by would be handled by trucks. Some of the manufacturers that have been doing a fairly good business would be handicapped because their trade extends over a larger territory and they are not in possession of storage space to permit them to continue manufacture of equipment that cannot be shipped. High-tension equipment manufacturers report the shipment of considerable amounts of apparatus this week in anticipation of the strike.

NO ALARM IN SOUTH OR SOUTHWEST

Up to date the strike has not been considered in the South to be sufficiently imminent to warrant material preparations for handling the situation. A preliminary organization is being discussed to meet the situation in case a strike occurs, but unless it shall appear that a strike is inevitable little actual preparation will be made by the electrical trade in that territory.

The contemplated strike is causing no particular concern to central-station companies and the electrical trade in the Southwest. Some of the smaller utilities have built up coal stacks to a slight extent, but in St. Louis because of water-power from Keokuk and the fact that coal can be obtained from nearby mines in spite of a strike, no special measures are being taken to insure coal delivery. Electrical con-

sumption will not be affected unless the strike is protracted. Jobbers and dealers will continue to buy in regular manner pending development.

PACIFIC COAST STATES RELY ON CANAL

Electrical interests in the Northwest are not much concerned over the threatened disturbance, first, because they feel that the backbone of the strike has been broken and, second, because it would not seriously affect that district if it occurred, because a large part of the shipments now come by water through the Panama Canal and the rest could very easily be diverted. Some jobbers and manufacturers have already diverted shipments to the water route and others are making plans to do so. Stocks of jobbers and manufacturers are in most cases in good shape to withstand a temporary tie-up. A surprising thing about the situation is that virtually no attempt has been made on the part of users of electrical material to fortify themselves against a possible suspension of freight traffic, an indication that the trade generally does not look upon the situation with any great alarm.

The threatened railroad strike will have little or no effect on the electrical industry of the southern Pacific Coast because the stocks on hand are quite satisfactory and also because, just as in the Northwest, the majority of shipments are already being received via the Panama Canal. If necessary, all material can be supplied by this route. The distribution of supplies from the receiving centers is well in hand. Out of San Francisco the inland rivers offer an uninterrupted route to two of the principal central cities of the state, while the others may be readily served by motor trucks.

The utilities are also in a very good position. The steam stations receive their supply of fuel oil through pipe lines connecting through to the oil fields. Therefore the fuel supply will be uninterrupted. With but a few exceptions there are no large pieces of apparatus en route by rail at this moment, and the delay of these would not be serious. The most important of them is the material for the Pit River plant of the Pacific Gas & Electric Company. This job would be halted during the strike, and if it were long continued the working forces would have to be reduced with material loss in organization. All other apparatus and supplies may be received by water and distributed by motors.

A. S. M. E. to Talk About Education and Elimination of Waste

ELIMINATION of industrial waste will have especial attention at the annual meeting of the American Society of Mechanical Engineers, to be held in New York City, Dec. 5-9. The report of the American Engineering Council's committee on elimination of waste in industry will provide the basis for the discussion, which will emphasize the engineering phases of the waste problem. The leading session will point out the necessity for waste elimination and develop essential principles of standardization and stabilization. The professional sections will consider in technical fashion the steps that can readily be taken more effectively to utilize our national resources.

The tentative program shows an intimate relation between the leading session and the technical sessions of the professional division. Two sessions on education will be held, one under the auspices of the committee on education and training in the industries, which will present a program pointing ont the great need for education in the industries. Dean R. L. Sackett of the Pennsylvania State College will present in one of the papers a résumé of the status of industrial education throughout the country. Another paper, by D. C. Buell of the Railway Education Bureau, Omaha, Neb., will relate the steps taken by the railroads of the country for the training of their men. The second session on education will be a joint meeting with the Society for the Promotion of Engineering Education. Prof. Dugald C. Jackson is in charge of the program, which will give an opportunity for mechanical engineers to discuss with teachers the requirements of an adequate technical school training in mechanical engineering.

New Southern Interconnection Relieves Power Shortage in the Carolinas

RELIEF for the power shortage in the territory served by the Carolina Power & Light Company in South Carolina, as reported in the ELECTRICAL WORLD for Sept. 17, page 583, and Sept. 24,, page 633, has been brought about through a liberal exchange of energy by three large Southern companies, the Alabama Power Company, the Georgia Railway & Power Company and the Southern Power Company.

On Oct. 23 arrangements were completed to interchange energy between the system of the Alabama Power Company and the Georgia Railway & Power Company over a tie line which was recently completed between Gadsden and Lindale, Ala. Energy is now being transmitted from the Lindale substation of the latter company to the Boulevard substation in Atlanta over a 110,000-volt circuit. Use is being made of the double-circuit power line, which has heretofore been operated at 38,000 volts. A second circuit at 110,000 volts completes the direct line at this voltage from Lindale substation to the Boulevard substation in Atlanta. This energy is being absorbed by the system and its equivalent delivered to the Southern Power Company through the connection between that company and the Georgia system at the Tallulah Falls station. The Southern Power Company then delivers to the Carolina Power & Light Company the amount originally absorbed by the Georgia company, so that the interchange of energy through high-voltage trunk lines is now completed over a distance of something like 1,100 miles through four Southern states. The general plan in the interchange is to shift the distribution of load centers so as to absorb the energy exchanged at the service points nearest to the point where energy is received.

The Gadsden-to-Lindale tie line is a simple circuit with No. 3/0 aluminum conductors on the Alabama side and No. 4/0 aluminum conductors on the Georgia side, giving a capacity of 20,000 kw. At the present time the demand is fluctuating, ranging up to 10,500 kw. The entire interchange will be in the order of 150,000 kw.-hr. to 200,000 kw.-hr. a day. Besides taking power from the Alabama system, the Georgia Railway & Power Company furnishes about 10,000 kw.-hr. in the daytime to the Columbus (Ga.) Power Company and at night obtains 20,000 kw.-hr. It also takes about 2,500 kw. demand from the Tennessee Power Company, which in turn is obtained from the Maryville (Tenn.) plant of the Aluminum Company of America.

Report Submitted on Cost of Columbia River Project

THE report of the board of engineers commissioned by the Umatilla Rapids Power Site Association to inquire into the results and probable cost of constructing a dam in the Columbia River about 3 miles east of the town of Umatilla, 180 miles east of Portland, Ore., and utilizing the head of water thus obtained for hydro-electric power and irrigation purposes, was submitted recently to the association at a meeting held at Pendleton, Ore. The report was prepared by John H. Lewis, former State Engineer, with the assistance of a number of other engineers of prominence. The cost of the report was borne by the association, aided by appropriations by the State Legislatures of Oregon and Washington.

Besides canalization of the Columbia River for navigation purposes above the dam site, it is proposed to develop irrigation facilities by pumping water for the irrigation of 270,000 acres of land within 45 miles of the dam and to develop from 125,000 hp. to 500,000 hp. for railroad operation, irrigation pumping, municipal and domestic supply and for industries within the Columbia basin extending from Spokane and western Idaho to Puget Sound and Portland.

The height of the proposed dam will be 30 ft., backing the water up in the Columbia nearly to its junction with the Snake River. The estimated cost of the project varies from $12,000,000 to $27,960,000, according to the extent of the work. It is proposed that the development shall be a federal government undertaking carried through in co-operation with state and local community effort.

Pacific Gas & Electric Will Get Energy from Irrigation Districts

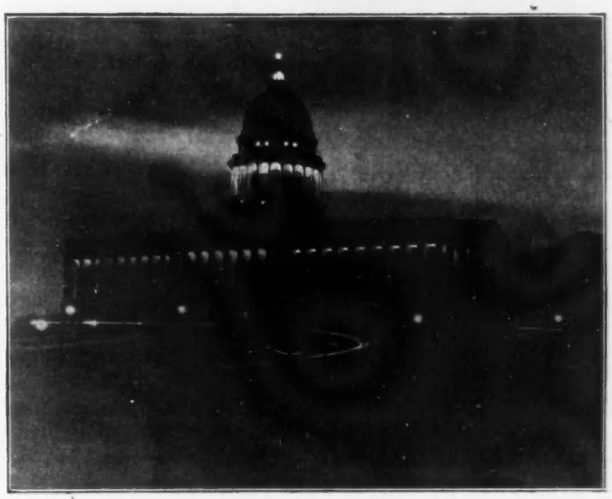
THE California Railroad Commission has approved an agreement between the Pacific Gas & Electric Comapny and the Sierra & San Francisco Power Company with the Turlock and Modesto irrigation districts enabling the latter to proceed with the Don Pedro storage project. Under the terms of the agreement the irrigation districts acquire the La Grange power plant and Tuolumne River water rights, owned by the Sierra company and under lease to the Pacific company. As a consideration the irrigation districts agree to furnish to the power companies 10,000,000 kw.-hr. of electrical energy a year for twenty-five years. This power is to be developed at a generating plant to be built by the districts in connection with the storage dam. It was necessary for the districts to acquire the La Grange plant, as the proposed storage reservoir will submerge several miles of the company's ditch supplying the plant' and the agreement reached by the respective interests avoids the condemnation proceedings.

In passing on the application the commission defines the transaction as substantially a sale of public utility property on an installment basis of payment and finds that the agreement is to the advantage of both parties. At a rate of 4 mills per kilowatt-hour and an interest rate of 8 per cent the present value of the power covered by the contract is placed at $427,000. From the viewpoint of the Sierra company and its consumers the price is entirely adequate, the commission says, and it adds:

"While it is not a subject for consideration by the commission, it is of interest that by passing through its power plant the water which would otherwise be used by the Sierra company, the irrigation districts can generate enough power to satisfy the requirements of this contract and that the cost of the additional generating machinery required will be less than the additional cost of the gate tower, gates, trash racks, etc., that would be required if water were to be passed through the dam to supply the existing canal and power plant."

Nightly Illumination of Utah State Capitol Has Brilliant Effect

AN INTERESTING example of the remarkable effectiveness of electric lighting is the illumination each night of the exterior of the Utah State Capitol at Salt Lake City. This beautiful building, at the head of State Street, with a commanding view of the entire Salt Lake Valley, now maintains its prominence after dark as well as in the daylight. The electric



lights which blaze forth from its dome, cupola and colonnade have transformed its gray outline against the darkened sky into an inspiring picture. Starting at the top, the ball on the dome is surmounted by a cluster of fourteen 200-watt lamps. On the cupola are four 250-watt lamps. Around the upper circle of the dome are twenty-four 60-watt white tungstens, and the lower circle of the dome is lighted by twenty-five 100-watt clear tungstens. Straight under the colonnade there are ninety-six 100-watt clear tungsten lamps, extending around three sides of the building—twenty-four lamps on the east side, forty-eight on the south and twenty-four on the west.

New England Division, N. E. L. A., Names New Chairmen

FOUR special section chairmen have been named for the New England Division, National Electric Light Association, following the recent annual convention at New London, Conn.: Accounting Section, F. J. Stanwood, Boston, consulting accountant; Commercial Section, Fred H. Smith, assistant general manager Worcester Electric Light Company; Public Relations Section, Edwin A. Barrows, president Narragansett Electric Lighting Company, Providence; Technical Section, Roy F. Whitney, manager Fall River (Mass.) Electric Light Company.

Bonds Must Be Backed Substantially with Junior Securities

JOHN B. MILLER, president of the Southern California Edison Company, with headquarters at Los Angeles, is a born optimist. He and his efficient staff have, through the exercise of indomitable ambition and unflagging energy, placed the name of their company high up in the records of electric public utilities for progressiveness, growth and public performance. Mr. Miller himself is a notable example for the emulation of any aspiring public utility operator. No man is better acquainted than he with the conditions, faults and requirements of modern electric light and power systems, particularly as regards financing, and therefore he speaks on this subject with a full measure of authority. When he was in the East early in October conferring with New York and Boston bankers on the enlarged financial program of the Southern California Edison Company, there was no question in his mind of lack of financial support for the immense hydro-electric development his company has in hand or in contemplation, nor had he any doubt of the ability of his organization to dispose of the additional billions of kilowatt-hours of energy which would be made available. Considering that the Southern California Edison Company is one of the biggest operators in the world and its building program is perhaps larger than that of any other utility in the country at the present time, Mr. Miller's confidence in the electrical outlook is as reassuring as it is refreshing.

J. B. MILLER

When asked to discuss the crucial question of public utility financing Mr. Miller reverted to the history of his own company and confirmed the frequently expressed conviction of investment bankers and others that electric light and power companies should raise from 30 to 40 per cent of the money needed for new work through the sale of junior securities and the remainder through the sale of bonds. In Mr. Miller's estimation, it is no longer possible to build power plants entirely from the proceeds of bonds and it is now imperative to provide each bond with an ample margin of equity through the sale of stock, as well as to safeguard the company and its operations through wider and more democratic ownership of the property. Mr. Miller remarked that proficiency in the latter accomplishment, with all that it implies in the important matters of public relationship, service, rates, etc., is just as much a necessity as the efficient operation of the plants themselves.

For the greater part of its funds the Southern California Edison Company still looks to the investment bankers. While naturally the company would be pleased to have all of its bonds in the hands of residents of the State of California, it is content to rely on the initiative and experience of the bankers themselves in placing such securities. When it comes to the sale of junior securities, however, the company has a more direct and personal interest than the bankers in raising funds by this means. Obviously the bankers are pleased to have the company assume the obligation since it can appeal to a clientèle beyond the reach of the ordinary banker or broker and self-interest will prompt it to do the job well.

Mr. Miller is obsessed by the urgency and importance of building up a feeling of good will for the Southern California Edison Company, particularly among its patrons. As a prerequisite he first interested the employees of the company by taking them in as partners through the sale of stock on deferred payments. Having lined up the organization so that every man was as enthusiastic as himself over the plan, the next move was to interest patrons of the company and the general public. The results obtained were truly remarkable.

Since Jan. 24, 1921, and up to Sept. 30, the Southern California Edison Company, through its own employees, sold to the people in the territory which the company serves in southern and central California $10,474,800 par value of its common stock. This stock has been purchased by 20,790 individuals. On Oct. 1 3,373 of the company's own employees were stockholders. Although the company has a small department expressly equipped to supervise the sale of its junior securities to the public in the territory served by the company's lines, the actual sales are made by the employees, every one of whom, in addition to his regular duties, is a stock salesman.

Department of Greater Service

Recently the company has established a department of greater service whose function is to ascertain at first hand the attitude of the public toward the company and to create in turn an interest in the company's affairs. The men intrusted with this diplomatic work have, of course, a pleasant approach and are thoroughly familiar with the history, organization, operation, practice and aims of the company, as well as with the broad questions of public policy and the relationship and importance of electric public utilities to the general advancement and development of the community and state. By this means the Southern California Edison Company has evolved a public relationship of immense value to it. To quote Mr. Miller: "Our customers now know in a more personal and intimate way just what we are and what we stand for. Moreover, they are pleased with the attention and courtesy shown them, and when they are invited to become part owners of the property a great many of them gladly accept. I need hardly dwell on the importance of this to any utility company and on the element of strength which customer ownership imparts to it, but a phase which appeals to me greatly is the effect all of this has on the officers and employees of the company itself. So keen is the interest of each employee in the stability and continued growth of the company that more than 90 per cent of them own stock. Every employee of the company is a salesman of its securities. He first 'sells' himself and then his neighbors and friends, thereby creating an entirely new group of investors. No investment banker could reach this class so thoroughly and effectually and no broker could command the confidence which impels a man who never before in his life made an investment to trust his savings with a company whose employees, policies and savings are as an open book to him. It is all a question of winning the public and keeping faith with them."

Southern Operating Men Hold Meeting

THE American Association of Operating Engineers held its last meeting for the year on Oct. 6, 7 and 8, in the Southern Club Building at Birmingham, Ala., with fifty present. Owing to the absence of H. L. Wills, G. A. Iler of the Georgia Railway & Power Company acted as chairman. An address of welcome was given by R. A. Mitchell, vice-president of the Alabama Power Company. It was decided to hold the next meeting at Columbus, Ga., by invitation of the Columbus Power Company.

A committee was appointed at the suggestion of Mr. Mitchell to take up with the Southeastern Section of the National Electric Light Association the feasibility and advisability of affiliating the A. A. O. E. with the N. E. L. A. Discussions were had on the advantages and disadvantages of the use of choke coils on high-tension lines, the correct location of lightning arresters, the half-soling of wooden poles used for high-tension transmission, the operation of superpower zones, and a number of other equally interesting subjects. A lecture, with a blackboard diagram, was given by James McC. Oliver of the Alabama Power Company. Mr. Oliver is an authority on correct relay protection.

C. E. Bennett spoke entertainingly on choke coils and surge arresters and their proper application, giving a demonstration with working models of the way in which high-tension transmission lines are protected from direct strokes of lightning and from inductive influence caused by flashes in the neighborhood, as well as from surges due to switching operations and arcing grounds.

On the evening of the second day the Alabama Power Company gave a banquet to the association, and Mr. Mitchell acted as toastmaster.

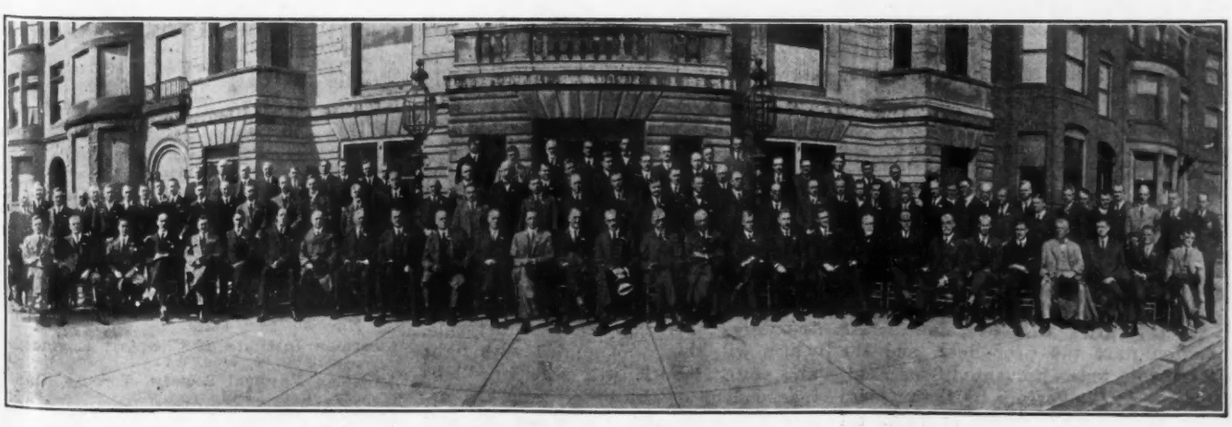
Directory of Manufacturers and Users of Electric Heating Equipment

IT IS officially announced that the industrial heating division of the Power Sales Bureau of the National Electric Light Association is about to compile a directory of manufacturers and users of industrial electric heating equipment, including steel furnaces, non-ferrous furnaces, heat-treating furnaces, japanning ovens, drying ovens, core ovens, bread-baking ovens (commercial), welding and rivet-heating equipment and electrochemical appliances. Manufacturers of such equipment are invited to supply data upon it to R. T. Kaighin, in care of the Cleveland Electric Illuminating Company.

Stone & Webster Managers Dedicate Organization to Greater Service

MANAGERS of public utilities administered by Stone & Webster, Inc., devoted the week beginning Oct. 10 to a vigorous and enthusiastic convention at the home office in Boston, 117 representatives being present from all parts of the continent. A keen sense of the opportunities for greater service through the best public relations in the central-station, gas and railway industries was manifested at the meetings. Delegates returned homeward more than ever convinced of the wonderful prospects for further development of electric service companies administered in accord with popular friendship and participation by the public in security ownership. Forty-three utilities, with a total capitalization of $219,000,000 face value, were represented.

The principal speakers, Harry H. Hunt presiding, were Charles A. Stone, president American International Corporation, New York, whose topic was "The Relation Between International Affairs and Public Utilities"; Edwin S. Webster, "The Principles of Our Organization"; Russell Robb, "Post-War Economic Conditions"; H. G. Bradlee, "The Management Contract"; H. A. Lemmon, "The Little Things"; C. W. Kellogg, "Public Relations"; Henry R. Hayes, New York office, "Street Railway Publicity"; G. O. Muhlfeld, "Achievement of the Engineering Division"; F. P. Royce, "Relations of Securities Department to Management"; Samuel M. Kennedy, vice-president Southern California Edison Company, Los Angeles, "Public Relations and Greater Service"; A. S. Pratt, "Relations of the Manager to the Firm"; H. T. Edgar, "Team Play and Employees' Clubs"; L. C. Bradley, Houston, Tex., "District Co-operation"; H. L. Rogers, "Development of the Division of Construction and Engineering"; F. S. Pratt, "New Developments"; H. B. Sawyer, "Taxation Conditions and Problems"; George Harrington, manager Chicago, Wilmington & Franklin Coal Company, Chicago, "Coal-Mining Activities"; J. T. Ingle, Haverhill, Mass., "Humanizing Company Forms"; J. A. Hunnewell, Lowell, Mass., "Training Employees for Contact with Customers"; N. H. Daniels, "Development of the Statistical Department," and Leonard Buchanan, "Lumber Activities." At a luncheon over which W. H. Blood, Jr., presided, George J. Baldwin, New York, spoke on "Stone & Webster and Hog Island"; M. C. Brush, New York, "How I Joined the Circus," and Elliot Wadsworth, Assistant Secretary of the Treasury, Washington, on "Government Finances."



STONE & WEBSTER MANAGERS GATHERED AT BOSTON CONVENTION

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Narragansett Company Increases Generating Capacity.—To meet the demands imposed by a rapidly growing load the Narragansett Electric Lighting Company of Providence, R. I., has built an addition to its turbine building designed to house a unit rated at 45,000 kw., which will raise the total generating capacity of the station to 125,000 kw.

Long-Distance Telephony in China.—Work, it is reported, has begun on a telephone line between Shanghai and Pekin. This line will connect with the 100-mile system now in operation between Pekin and Tientsin. The new line, which is to be completed before 1922, will be constructed according to American standards at a cost approximating half a million dollars. The total number of telephone subscribers in Chinese cities is put at 55,000.

Chicago Police Adopt Radio Telephony.—The radio telephone has been called upon by the Chicago police and fire departments to aid their work by enabling the chiefs of the forces to keep in communication with their subordinates. The cars of both departments are to be equipped with wireless instruments that will enable the occupants to receive messages spoken from headquarters, miles away. A trial in the police department gave entirely satisfactory results.

Progress at Logan, W. Va.—Upward of $2,250,000 is being expended, according to a report in the *Manufacturers' Record*, in the construction of an additional generating plant with a capacity of 30,000 kw. at Logan, W. Va., by the Kentucky & West Virginia Power Company; plans are being made for erecting about 100 miles of additional transmission lines in Kentucky and West Virginia to supply coal mines and other industries, and the building of an additional power house in the Big Sandy district of Kentucky is contemplated.

Electrically Driven Ferryboat Accommodates More Vehicles than Old-Type Boats.—The Poughkeepsie & Highland Ferryboat Company, which operates a ferry service across the Hudson River between Poughkeepsie and Highland, N. Y., is soon to operate an electrically propelled "hull-fin" ferryboat which marks an advance in the construction of such craft. Electric motors are mounted next the propellers, and the water projected is prevented from readily rising to the surface by the unusual width of the hull, which contains all the boat's machinery. The space thus gained permits of four driveways instead of two, as in the old boats. The largest ferryboats now in use have a length of 225 ft. and a width over beams of 60 ft., giving 110 sq.ft. for the accommodation of vehicles. The "Poughkeepsie," as the new boat has been christened, has a length of only 140 ft. and is 52 ft. over beams, but has an area of 472 sq.ft. for accommodation of cars and trucks.

Electric Enameling.—What is said to be the only electric furnace in the country for enameling stove parts has recently been put into operation by the Galusha Stove Company, Rochester, N. Y. The furnace was largely an experiment, but its product is said to be far superior to that enameled in any other way. The furnace takes 115 kw. and supplies an off-peak load.

How Electricity Helps Clear the Atmosphere. — By means of a tank equipped with a two-cylinder compressor driven by a motor rated at 0.5 hp., explains *Factory*, the air in textile and knitting mills is freed from lint and bits of thread which would otherwise accumulate in sewing machines, motor windings and the bearings of the line shafting and necessitate frequent stopping of the plant for cleaning. The outfit employed to blow this dust away is portable and produces an air pressure of from 60 lb. to 90 lb. With this equipment one man can clean twenty-five motors of from 2-hp. to 5-hp. rating, nine sewing machines, seventy-five electric fans and the shafting. In knitting mills, however, where every machine must be cleaned several times daily, there is a central compressor plant with pipe lines carrying the air to each machine.

The Scottish Water Powers. — That the scheme for linking up the small water powers of Scotland has possibilities of magnitude is the opinion of experts as recorded by the London *Electrician*, which abstracts a recent paper by Prof. F. G. Baily on this subject. The scheme proposed is to utilize the rapid streams and waterfalls of the high uplands and the rivers of the long, gently sloping valleys by numerous small hydro-electric stations so that the rainfall will pass through a succession of turbines in its passage from the gathering ground to the sea and yield up a fair proportion of its energy. The substations must be small, probably from 50 hp. to 300 hp., in order to avoid the need for large dams and long pipe lines. The central station it is proposed so to design that it will make up the irregularities of the load and supply the magnetizing current for the small dynamos. In some districts much of the power from the small stations will never reach the central station, for the collecting mains will also act as distributers to the adjacent countryside, which will thus be supplied with light and power. Each little station will be independent of the others and not affected by additions. Hence the financial risk will not be great.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Providence Section, A. I. E. E.—This section will meet on Friday, Nov. 4, at 8 p. m. W. I. Middleton, electrical engineer Simplex Wire & Cable Company, will speak on the manufacture of insulated wire and cable.

Philadelphia Section, A. I. and S. E. E.—The topic already announced for the Nov. 5 meeting of this section, "Operation and Care of Power Transformers," will be discussed by J. G. Corrin of the Pittsburgh Transformer Company, Pittsburgh.

Providence Engineering Society.—A meeting of the power section of this society is scheduled for Tuesday, Nov. 1, when G. R. Rowland and W. F. Osborne of the Texas Company will speak on "The Manufacture and Application of Lubricating Oils." The American Society of Steel Treating will meet at the Engineering Society's rooms on the following evening, Wednesday, Nov. 2.

N. E. L. A. Committee Meetings.—Technical national section meetings of the N. E. L. A. are scheduled for November as follows: At Cleveland—Nov. 14 and 15, main groups of committees on inductive interference, meters and underground systems; Nov. 16 and 17, sub-groups of committees on electrical apparatus, overhead systems and hydraulic power; Nov. 17 and 18, main groups of committees on prime movers and safety rules. At San Francisco—Nov. 14 and 15, sub-groups of committees on inductive interference, meters and underground systems; Nov. 16 and 17, dual groups of committees on electrical apparatus, overhead systems and hydraulic power; Nov. 17 and 18, subgroups of committees on prime movers and safety rules.

Coming Meetings of Electrical and Other Technical Societies

Industrial Relations Association of America —New York, Nov. 1-5.

A. I. E. E., Providence Section—Providence, Nov. 4.

A. I. and S. E. E. Philadelphia Section—Philadelphia, Nov. 5.

N. E. L. A., Pacific Coast Section—Del Monte, Cal., Nov. 11.

Electric Power Club—Cleveland, Nov. 14-15.

A. I. E. E. and Society of Naval Architects and Marine Engineers — New York, Nov. 17.

American Physical Society—Chicago, Nov. 25-26.

Electrical Supply Jobbers' Association — Pacific Division—Del Monte, Cal., Nov. 10-12. Atlantic Division — Cleveland, Nov. 30, Dec. 1-2.

American Institute of Chemical Engineers —Baltimore, Dec. 6-9.

American Physical Society—Toronto, Canada, Dec. 27-31.

American Association for the Advancement of Science—Toronto, Canada, Dec. 27-31.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Commission Has No Power to Compel One Company to Supply Another.—Finding, in Village of St. Clairsville vs. Public Utilities Commission, that the commission may allow a gas company to discontinue service to a municipality if satisfied that the company has no longer a supply of gas, the Supreme Court of Ohio also decreed that the commission has no power to compel one such company to supply another in order to enable the latter to comply with a contract to serve. (132 N. E. 151.)*

City Cannot Enjoin Rates Specified in Schedule Filed with Commission.—Declaring that under the statutes a city cannot sue as a consumer of gas and electricity to enjoin the collection of rates specified in a schedule filed with the Public Service Commission, the Supreme Court of New York dismissed the complaint in City of Oswego vs. People's Gas & Electric Company of Oswego. The law authorizing the commission to investigate complaints made by the mayor of a city does not authorize a municipality to maintain an action in the courts to enjoin the collection of rates alleged to be excessive. (190 N. Y. S. 39.)

Judicial Functions and Judicial Powers.—The Natatorium Company, which furnishes hot-water service, having sued the Public Utilities Commission of Idaho, which the company sought to prohibit from interfering with it until it could be judicially determined whether the company is or is not a public utility, the Supreme Court of Idaho has denied the writ sought, declaring that in the exercise of its statutory powers the commission must in every instance pass upon the question of its own jurisdiction and that in so doing it does not exercise a judicial power but only a judicial function. (200 Pac. 348.)

City Violating Commission Order Not Liable for Damage Where Company Occupied Street Without Franchise.—Singerney vs. City of Los Angeles was a damage suit brought by a brakeman who while climbing his car was injured by contact with a street-lighting pole. The Supreme Court of California has reversed the lower court, which held the city liable because of its violation of a Railroad Commission order prohibiting the placing of poles within a certain distance of railroad tracks. The upper court holds that this violation was not negligence because the railroad company was using the street without a franchise and was therefore a trespasser, and the plaintiff, being a mere licensee, could not complain of the unsafe condition of the premises where he was injured. (200 Pac. 380.)

Acceptance of City Franchise Does Not Invalidate Former Franchise.—The Supreme Court of California in an action brought by the city of Oakland against the Great Western Power Company has found that where an electric light and power company furnished electricity for lighting under a constitutional franchise it did not surrender that franchise by bidding for and accepting a franchise under a city charter. The acceptance of the city charter was held not to necessitate payment of a percentage of receipts from electricity furnished for lighting purposes contrary to the terms of the prior franchise. (200 Pac. 395.)

Commission Must Dismiss Application Affecting Rights Involved in Pending Suit.—On application of the New Bremen-Minster Gas Company the Public Utilities Commission of Ohio granted the company leave to withdraw its service and facilities from the municipalities it had supplied, it being alleged that the natural gas depended upon was exhausted. The village of New Bremen thereupon brought suit against the commission, and the Supreme Court of Ohio has reversed the decision on the ground that the matter was already involved in litigation and that therefore it was the duty of the commission to dismiss the application. (132 N. E. 162.)

Contract Prohibiting Change of Rates Invalid.—The United States Court of Appeals has reversed the Nebraska District Court in City of Kearney vs. Central Power Company, the upper court holding that a contract between the city and the company precluding the company from increasing or decreasing rates during the life of the franchise—twenty-five years—is invalid as infringing the statutory provision that power to regulate rates shall not be abridged by ordinance, resolution or contract. The provisions of such a contract, the court holds, are unenforceable against the company for want of mutuality. (274 Fed. 253.)

Right of Appeal from Commission.—The jurisdiction of the Oklahoma Supreme Court over commission decisions, as laid down by the court in Atchison, Topeka & Santa Fé Railway Company vs. State, is merely, on appeal being made to it, "to consider and determine the reasonableness and justness of the action of the commission appealed from or any other matter arising under such appeal. The order of the commission or rate fixed by it shall be regarded as prima facie just, reasonable and correct. If in the opinion of the court the evidence taken before the commission and certified to the court overcomes this prima facie presumption, it is then the duty of this court to make such order or fix such rate as it deems just, reasonable and correct." (200 Pac. 232.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Powers of Michigan Commission.—Complaint made by a customer of the Peninsular Electric Light Company that the company charged rates in excess of those fixed by contract has been dismissed by the Michigan Public Utilities Commission, which declares that it has all the power over rates which the Michigan Railroad Commission had before its supersession, including the power that had been exercised in the case under review—that of eliminating discriminatory features from rate contracts.

Valuation of Company Serving Small Villages.—In ordering a reduction of the rates charged by the Katonah Lighting Company in the hamlets of Katonah, Bedford, Bedford Hills and Bedford Center, the New York State Public Service Commission made the following decisions: The value of a steam generating plant not in actual use on account of a three-year contract by which the utility received energy from a wholesale supply company was included as an item of fixed capital; no allowance was made for organization and general overhead expense, on the ground that the books should include all capital expenditures, the utility having been under commission control virtually since its inception; working capital should include what is necessary for materials and supplies and also a sum large enough to enable the company to operate until its current dues have been received; a transmission loss of 38.2 per cent of current is excessive; a return of 8 per cent is reasonable.

Non-Operative Electrical Companies Forfeit Charters in Pennsylvania.—Declaring that a charter issued to a company two years ago had been forfeited because no use had been made of it, the Public Service Commission of Pennsylvania recently, over the protest of the original company, authorized the issue of a charter for the same territory, in Jefferson County, to the Snyder Township Light, Heat & Power Company. There are said to be many cases in central and western Pennsylvania where charters have been granted to "paper" companies which have failed to exercise their rights under these instruments, some of the companies having been merged into larger enterprises and others holding the charters for future exploitation. The decision of the commission in the Snyder Township case foreshadows a policy on its part that will make non-exercise of franchise rights automatically invalidate them in the case of these rural supply companies. The state law requires work to be done within two years.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

Fred Norcross, secretary and manager of the Home Gas & Electric Company, Greeley, Col., who was elected

FRED NORCROSS

president of the Colorado Electric Light, Power & Railway Association at its recent convention at Glenwood Springs, started his career in the electrical industry as a telegraph operator in 1889. Later he became a train dispatcher with the Union Pacific Railroad, afterward chief dispatcher for the Colorado & Southern Railroad, and then chief dispatcher and trainmaster and later assistant superintendent of the St. Louis & San Francisco Railroad. In 1913 he was appointed to his present post.

Harold L. Geisse, who has gone to Wausau, Wis., as the assistant general manager of the Wisconsin Valley Electric Company, operating at Merrill, Wausau, Stevens Point and intermediate communities, is a graduate of the University of Wisconsin, class of 1905. Subsequent to his graduation he was statistician of the Railroad Commission of Wisconsin. He was with the American Light & Traction Company at San Antonio, Tex., for five years and then returned to Wisconsin to serve again as statistician of the Railroad Commission and later as secretary. He then became associated with the Insull interests in Chicago, first as assistant to the president of one of the property groups and then as secretary and treasurer of the Wisconsin River Power Company, the Southern Wisconsin Power Company, the Wisconsin Power, Light & Heat Company, the Central Wisconsin Utilities Company and the Mineral Point Public Service Company and as secretary and treasurer and general manager of the Janesville Electric Company.

L. Broadus Moore has taken charge of the operation of the plants in Georgia of the Georgia Alabama Power Company. Mr. Moore was formerly manager of the Alabama division of the company.

Albert L. Couch has succeeded L. Broadus Moore as manager of the Alabama Division of the Georgia Alabama Power Company. For several years Mr. Couch was superintendent of the water and light plant at Lexington, N. C., and later built and managed the Franklin District plant of the Georgia Railway & Power Company. He was later engaged in manufacturing in Memphis.

W. S. Hall, the new president of the Association of Iron and Steel Electrical Engineers, is the electrical engineer of the Illinois Steel Company, Chicago. Mr. Hall was graduated from the electrical engineering course at Purdue University in 1905. Soon after graduation he became associated with the Willard Storage Battery Company at Cleveland. In 1907 he joined the Baker Motor Vehicle Company as wireman and later was promoted to be foreman. He left this company in 1910 and joined the engineering organization of the American Steel Foundry at Hammond, Ind. After staying there a year, he moved to Chicago and entered the South Chicago works of the Illinois Steel Company. Working his way up through the ranks, he was appointed electrical engineer in February, 1917. Mr. Hall has been an active worker in

W. S. HALL

all departments of the Association of Iron and Steel Electrical Engineers and has served as director of this association. He is also a member of the A. I. E. E.

Harold Wright, chairman this year of the National Electric Light Association committee on commercial service and relations with customers, was born in Schenectady, N. Y., in 1882. In 1890 his family moved to Chicago and he was educated in the Chicago schools. In 1900 he obtained a position in the Northern District office of the Commonwealth Electric Company. When the consolidation of this company and the Chicago Edison Company resulted in the formation of the Commonwealth Edison Company he was transferred to

HAROLD WRIGHT

the main office of the new company, where he soon was made chief clerk of the contract department. Through him the application bureau of the contract department was established, which permitted application for electric service to be made by telephone, and at present he is in charge of that bureau. He has served as a member of several committees in the company section of the N. E. L. A. and was vice-president of the section in 1915-1916. He has served as a member of the committee on commercial service and relations with customers of the N. E. L. A. since 1917 and, as already mentioned, is chairman of that committee for 1921-1922.

John E. Harvell has been made general manager of the Richmond-Petersburg division of the Virginia Railway & Power Company, succeeding C. B. Buchanan, resigned. In addition to his new duties Mr. Harvell will continue to have full charge of the company's light and power business throughout the entire system. Mr. Harvell has had thirty-four years' experience in the public utility field, working his way up from the position of lineman with the Upper Appomattox Company, a pioneer developer of hydro-electricity. When the Virginia Railway & Power Company was organized in 1909 Mr. Harvell was continued in charge of the operation of the interurban and Petersburg railways that were taken over and later assumed in addition supervision over the companies' light and power properties at Weldon and Roanoke Rapids, N. C. In 1918 he was ap-

pointed general superintendent of all the light and power divisions of the system, including Richmond, Norfolk, Portsmouth and Suffolk. During the war Mr. Harvell constructed a high-tension transmission line between Richmond and Norfolk in remarkably quick time and under trying conditions.

Oswald Dale has resigned from the Irvington Varnish & Insulator Company, of which he was vice-president and general manager. He had been with the company for five years. He was previously with the General Electric Company for eleven years, nine years of which were spent in the department of supervision of production and two years in the insulating division. For two years prior to that he had been in charge of the heating-device production of the Cutler-Hammer Manufacturing Company. Mr. Dale has just returned from a nine weeks' trip in England and France, where he has been investigating the market for insulating materials.

OSWALD DALE

A. M. Lockett, president of the A. M. Lockett Company, has been appointed to a two-year term on the board of Port Commissioners of New Orleans by Governor John M. Parker. Mr. Lockett started the business in which he is now engaged in 1899, having been previously assistant general sales manager of the Worthington Pump & Machinery Company. He is a mechanical and electrical engineer and a graduate of Stevens Institute, Hoboken, N. J.

Herbert S. Evans, who for twenty years has been connected with the General Electric Company, the past ten of which he served as an executive in its foreign department, has become president of the "Bleh" Company, New York City, commercial adviser to manufacturers. Mr. Evans writes that he has felt for a long time that certain American manufacturers of electrical goods, particularly the smaller ones, were in need of expert advice which would make it possible for them properly to market and distribute goods for which there is actual need, and it is in this work that he will be more especially engaged.

Obituary

Senator Frederick Nicholls, chairman of the board of directors of the Canadian General Electric Company, who, as noted in last week's "Men of the Inductry," recently underwent a serious operation, died in Toronto on Tuesday of this week. Senator Nicholls was born in England in 1856 and was educated in Stuttgart, Germany. After going to Canada in 1874 he was for seven years secretary of the Canadian Manufacturers' Association, and until 1893 he was editor and proprietor of the *Canadian Manufacturer*, which he founded. The first electric lighting company in Canada, the Toronto Incandescent Light Company, which was established in 1889, was the result of Senator Nicholls' efforts. This company subsequently obtained the exclusive Canadian rights to the Edison lighting system, and it was amalgamated with the Toronto Electric Light Company in 1891, giving way to the Toronto Construction & Electrical Supply Company, which acted as Canadian agent for the Thomson-Houston Company. From this amalgamation sprang the Canadian General Electric Company, organized in 1892, of which Senator Nicholls became president in 1913, resigning that office only last spring to become chairman of the board. Senator Nicholls' abounding activities were not limited to one company however important. He was keenly interested in the promotion of the first electric street railway system and the first interurban railway of the Dominion, and he built the hydro-electric system of the Electrical Development Company of Ontario, with its power house at Niagara Falls and an 85-mile transmission line to Toronto.

FREDERICK NICHOLLS

He had been president, vice-president or director of about thirty large Canadian manufacturing or commercial companies and took a prominent part in electrical development at Rio de Janeiro and Sao Paulo, Brazil. He was an honorary lieutenant-colonel of the Canadian military forces, took a prominent part in activities connected with the war, and in 1917 gained his title of Senator by appointment to the Upper House at Ottawa. In 1896 Mr. Nicholls was elected president of the National Electric Light Association, he having been the only president ever elected from beyond the United States.

Col. Spencer Borden, president of the Fall River (Mass.) Bleachery, and for three years identified with the early development of the electric lighting supply business in New England under Thomas A. Edison, died Oct. 17 at Woodstock, Vt., as announced in the ELECTRICAL WORLD of Oct. 22. Colonel Borden was one of the most prominent men in the New England textile industry, but his activities in this direction never caused him to lose interest in electrical development, although he had borne no active part therein for more than a generation. He was born at Fall River in 1849 and was graduated in 1868 from the Brooklyn Polytechnic Institute, specializing in chemistry. He studied for several years in France and on returning to America entered the textile field. In 1872 he organized, planned and built the Fall River Bleachery, at that time being elected a member of the American Association for the Advancement of Science. His work at Fall River attracted the attention of Mr. Edison and in 1881 he was made New England district manager for Mr. Edison's various interests, engaging chiefly in the direction of the commercial installation of isolated plant and mill lighting systems. From these beginnings and because of the knowledge Mr. Borden and his associates had of the textile industry developed in large measure the success of the General Electric Company in mill-power engineering. Upon the death of a brother, Mr. Borden resigned his connection with the electrical industry in 1884, returning to Fall River and continuing for the remainder of his life to exert a powerful influence upon textile affairs.

SPENCER BORDEN

Trade and Market Conditions

Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

Hardware Association Recommends Price Cuts to Pre-War Levels

IN VIEW of the fact that store and building hardware is distributed in much the same way and reaches largely the same consumers as electrical supplies, it is interesting to note that the executive committee of the National Hardware Association, in convention at Atlantic City last week, recommended that all hardware prices be cut to pre-war levels as a help toward readjustment. If the recommendation is carried out, the new scale of prices will be the same as in 1914 plus the differences due to increased costs and transportation. However, inasmuch as the advances were originally made necessary by mounting costs for labor, material and transportation, it is doubtful whether price cuts can be very startling while rates and material costs remain at their present levels. Every drop in cost so far has been immediately followed by a drop in price, a policy dictated by the competitive market.

Electrical supplies and wiring materials are in much the same position. It would be wise to cut to pre-war levels if only to get building started and business going, but prices at present are practically on a 1914 basis plus differences in cost of production and transportation. There have been fairly large decreases in raw material and labor costs of electrical supplies, but at no time has price failed to follow cost. It will be seen, then, that there is little room for hardware and, even less for electrical supply prices to move independently. However, any effect that the recommendation of the National Hardware Association may have cannot fail to be a good one. Even a further price reduction of a few per cent would be attractive to the building public.

Signs of Improvement in Collections

ADVICES from various sections of the country as noted by the National Electrical Credit Association indicate that the collection situation is experiencing a healthy improvement. While a few sections are still bad and others show only slight betterment, the general trend seems to be good and losses on new accounts are at a minimum. The year, nevertheless, will be one of the costliest from the standpoint of bad debts ever experienced by the industry. This condition is due almost entirely to accounts opened in the first few months of the year. Since June 1 there has been the necessity of scrutinizing all new credits closely, and as a result losses for the last part of the year will compare favorably with the average of other years. In the case of one large jobber the collection rate all over the country for the first seven months was more than 50 per cent higher than that of last year. This high average did not obtain for all jobbers, but conditions now show improvement over the early part of the year. At the present time the agricultural sections are perhaps slightly worse off than the industrial districts. On the Pacific coast low prices still rule the lumber market; in the Southwest cattle and oil are still comparatively low, and grain sections are still financially embarrassed. In the South cotton price increases have come to the rescue of business and a corresponding improvement is reported.

A report from Texas says that collections are getting slightly better, owing to cotton advances. Credits are rigid. Trade acceptances and notes are not generally being offered in settlement. Collections in Louisiana are on a sixty-day basis with improvement expected. Trade acceptances are not particularly desired. Atlanta reports contradictory statements on collections, some sections improving while in others planters are holding the cash received from cotton. St. Louis reports collections at sixty days and credits tight, and Omaha and Sioux City have noticed slightly easier collections.

Improvement has been shown in the East and particularly in the industrial districts. Detroit is still slow, but automobile production is picking up there and collections are better. Akron, Ohio, is reported to be showing very little betterment. Philadelphia, Pittsburgh and New York are considerably better than was the case ninety days ago as far as rate of collections is concerned. The collection basis still remains at sixty days. In the East there is a more general use of trade acceptances, and some jobbers feel that this has helped a great deal, resulting in a decrease in overdue investment and an increased turnover.

Value of September Electrical Exports Shows Decrease

THE stated value of electrical exports for September, 1921, is $4,878,883, showing a decrease of $2,429,210 as compared with September, 1920, and a decrease of $1,178,606 from the preceding month this year, but it is felt that the volume of exports has not fallen off in the same ratio. The difference in value between this year and last can be accounted for by the fact that many of the important items are much lower in price at present, while some articles are approximately even with pre-war levels. The stated value for the month, however, remains one of the lowest since October, 1919.

An encouraging factor is the showing of the first nine months of the year as compared with the same period last year, this year's total being $81,172,702 against $68,330,440 to Oct. 1, 1920. Only six articles show drops for this period, including batteries, carbons, interior wiring supplies, arc lamps, rheostats and controllers, and magnetos. Batteries registered the largest decrease, the figure being $1,627,629. Twelve totals show increases, some of the most important being dynamos and generators, fans, insulated wire and cable, meters and measuring instruments, motors, and transformers. Motors and transformers have the greatest increases, being respectively $4,573,508 and $3,999,810 ahead of the nine months' total last year.

ELECTRICAL EXPORTS FOR SEPTEMBER AND FOR FIRST NINE MONTHS OF YEAR

	September		Nine Months Ended September	
	1920	1921	1920	1921
Batteries	$607,936	$271,232	$4,885,262	$3,257,633
Carbons	119,233	42,402	1,085,831	347,306
Dynamos and generators	461,673	855,419	4,655,037	6,004,816
Fans	70,489	21,129	930,990	1,183,065
Heating and cooking apparatus	95,986	95,699	1,260,863	1,419,445
Insulated wire and cable	635,641	270,145	5,298,293	7,621,996
Interior wiring supplies	241,042	55,761	2,334,168	1,558,163
Arc lamps	1,053	455	1,764	629
Carbon-filament lamps	4,402	2,448	70,955	115,396
Metal-filament lamps	244,047	76,187	2,756,484	2,815,163
Magnetos, spark plugs, etc.	271,177	66,509	2,664,864	1,129,733
Meters and measuring instruments	190,331	191,411	1,868,300	2,347,921
Motors	1,230,408	537,558	8,899,123	13,472,631
Rheostats and controllers	33,309	45,304	1,161,604	886,628
Switches and accessories	281,635	159,690	3,047,824	3,670,045
Telegraph apparatus	38,093	65,563	481,434	886,173
Telephones	246,841	262,062	2,594,939	4,072,155
Transformers	208,493	353,033	2,980,186	6,979,976
All others	2,326,304	1,506,876	21,336,636	23,369,024
Total	$7,308,093	$4,878,883	$68,330,440	$81,172,702

A close comparison is possible between September and August of this year. Twelve items have fallen off while six have increased as compared with the previous month. It is interesting to note that transformers show the best increase here also, while fans show the largest drop from August values. Among the articles showing increases are batteries, carbons, dynamos and generators, heating appliances and meters.

As contrasted with September, 1920, exports there have been decreases on such items as fans, insulated wire and cable, metal-filament lamps, motors and switches, while dynamos and generators, meters, rheostats and controllers, telephones and transformers show gains.

Figures in the accompanying table have been received from the Bureau of Foreign and Domestic Commerce, Washington, D. C.

Unsettling Conditions Again Invade Copper Market

THE copper market, after the very encouraging activity of September, during which quotations rose to 13¼ cents, has again become quiet. The prime factor in the almost total cessation of buying since Oct. 15 has been the threatened railroad strike. In some quarters in the beginning the possibility of a rail tie-up was looked on more or less as a temporary embarrassment, but according to the opinion of an authority on the copper situation, as expressed to ELECTRICAL WORLD, the mere possibility of impeded transportation is having an effect which will be felt in the copper market for several months to come.

The first result has been the curtailment of buying to the point of negligibility, while producers' prices have tumbled to 13 cents per pound. Second hands who in reality possess only a small amount of the metal are able to supply what little demand there is at 12¾ cents. The opinion is general, however, that under no circumstances will prices drop to the level set during the latter part of August.

The real harm will come in connection with the reduction of surplus stock, which was proceeding at a very satisfactory rate during July and August and was as high as 60,000,000 lb. in September. On the first of September it was estimated that the surplus amounted to 1,250,000,000 lb., and had sales continued the rest of the year at the pace set in September, there is little doubt that the surplus would have been reduced to approximately 1,000,000,000 lb. by Jan. 1. From this total could have been deducted 340,000,000 lb. which has been financed for export and may, for all practical purposes, be disregarded as an actual factor. This would leave a free surplus of about 640,000,000 lb., of which about 300,000,000 lb. to 400,000,000 lb. would be considered in transit. In this way had sales continued in their September volume the first of the year would have seen little more than a normal surplus, and producers could have confidently begun to recruit their scattered mining and smelting forces.

As a matter of fact, October sales to the eleventh of that month were ahead of those for the same period of September, and the resumption of mining and refining might have occurred even slightly ahead of optimistic estimates. The cessation of buying, however, has put an entirely different face on the matter, and the re-establishment of mining activities as a consequence will have to be considerably postponed. At the present time mining in the United States is being carried on at 11 per cent of normal, while in South America it is at 46 per cent of normal. Mine and smelter forces have been widely scattered, and some authorities believe that it will be the summer of 1922 before normal refining can be resumed.

Thus far there have been no changes in finished copper and brass products to correspond with the let-down in demand. Large jobbers continue to quote No. 14 rubber-covered wire in 5,000-ft. lots at from $6.30 to $6.60. Weatherproof also has maintained its advance. Provided that copper producers are successful in their present attempt to maintain a price of 13 cents, wire prices are also expected to hold.

Encouragement Shown in Steel Poles and Towers

FROM reports received from producers of steel poles and towers for transmission lines there is considerable encouragement shown in certain quarters. Reports from other directions, however, indicate that business is not such as to hold up a very bright outlook for the coming winter. The business is spotty. Although it is true that the utilities have been very successful this year in floating securities, it is evident that not a great deal of this capital has been expended in towers to date. But the quality of the inquiries shows the future business now in contemplation. All classes of steel poles and towers have been considered in this brief survey. Another feature of the market is that while one month may be good the next may be off. Foreign business is providing a good market in some directions, notably the Far East and South America. Particular promise is held forth in the possibilities offered by electrifications of railways in Chile and Brazil, although it is expected that as much local labor and material as possible will go into this work.

Tower and pole prices are on lower quotations now than they were a month ago, in general. Five per cent is a representative price reduction, while in one instance it goes as high as 10 per cent. Late in September fabricated-steel prices suffered a reduction of about $2 to $3 per ton. The wireless field is providing an attractive market for fabricated towers, and with the development of this branch of the electrical industry a promising future is foreseen.

Further Reductions Announced on Iron Conduit and Outlet Boxes

RIGID iron conduit and outlet boxes have reflected the general trend in the iron and steel market by a further drop in prices. The new discount allows an additional 5 per cent from the price as figured on Card 48, which went into effect on Sept. 16. A new card has not yet been issued by conduit manufacturers, but these figures are approximately the same as were in effect in December, 1916, showing that pipe is back to where it was nearly five years ago.

Outlet boxes have dropped about 10 per cent. The new discounts in lots of 1,000 are 64 per cent for black boxes and 59 per cent for galvanized as compared with previous discounts of 57 and 53 per cent respectively.

Metal Market Situation

THERE has been little change in the metal market during the past week with the exception of a drop on steel rails of $7 per ton and the slight weakening of other steels. Lead demand has dropped off, but the New York price is unchanged on account of limited supply. The only movement in copper has been a ¼-cent drop on electrolytic, which is quoted now at 12¾ cents. Tin has achieved a small advance in the last two weeks in spite of the fact that the visible supply of tin has increased recently.

NEW YORK METAL MARKET PRICES

	Oct. 17, 1921	Oct. 24, 1921
Copper	£ s d	£ s d
London, standard spot	65 15 0	66 2 6
	Cents per Pound	Cents per Pound
Prime Lake	13.00	13.00
Electrolytic	13.00	12.75
Casting	12.37½	12.37½
Wire base	14.50	14.50
Lead, Am. S. & R. Co. price	4.70	4.70
Antimony	4.90	4.85
Nickel, ingot	41.00	41.00
Sheet zinc, f. o. b. smelter	10.00	10.00
Zinc, spot	5.15—5.20	5.10—5.15
Tin, Straits	28.00	28.50
Aluminum, 98 to 99 per cent	24.50	24.50

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	10.50 —10.87½	10.50 —11.00
Brass, heavy	5.00 — 5.50	5.00 — 5.50
Brass, light	4.50 — 5.00	4.75 — 5.00
Lead, heavy	3.50 — 4.00	3.75 — 4.00
Zinc, old scrap	2.25 — 2.37½	2.25 — 2.37½

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

THE shadow of the threatened railroad strike spread itself over the electrical industry this past week and buying as a consequence has been spotty. Chicago reports fair business in wire but quietness in other lines. Residence lighting-fixture business is good there, one utility having three times the normal number of unfilled orders. Steady though gradual improvement is noted in New York with less hand-to-mouth buying. Better demand for heating appliances is in evidence.

Jobbers in Atlanta are beginning to stock toys and holiday goods, but dealers are not placing orders yet. Stocks of heating appliances, dry cells and porcelain are low in St. Louis. Jobbers there report satisfactory business compared with other lines. Uneven improvement is noted in Boston, but it is encouraging to note that last week's building permit total was the best in twenty years. Better conditions are reported in the Northwest, the Intermountain region and in San Francisco. Holiday orders in the last-named place are comparatively light so far.

In no section of the country do jobbers seem to be worried about the railroad strike. Wherever possible shipments by water and truck are being planned. By some jobbers the possibility of a strike is being discounted, and there seems to be little stocking up in preparation for a freight tie-up.

NEW YORK

Trade continues to hold up well, and jobbers report that they can see a steady, although very gradual, improvement from week to week. An encouraging indication of greater confidence on the part of buyers is the fact that individual orders are increasing in size. There is not quite so much hand-to-mouth buying, and there is further evidence of dealers stocking up in anticipation of increased prices on some of the staple items.

Three important price changes were noted this week. Flexible armored conductor, for which there has been a strong demand for the past six weeks, has been advanced $2 per 1,000 ft. for No. 14, two-wire, single-strip. Iron conduit has been reduced 5 per cent by manufacturers and outlet boxes an average of 10 per cent.

A better demand for heating appliances is being shown, and jobbers report considerable buying for holiday trade. Air heaters are moving fairly well, and there appears to be more activity than there was a year ago.

Collections are reported to be on the basis of thirty to sixty days for current billings, but there is a general sentiment that conditions are improving.

Conduit.—An additional discount of 5 per cent on rigid iron conduit went into effect the first of this week. Jobbers have not issued a revised list of prices to conform with the new discount, but are quoting 5 per cent off on the following: For ½-in. black pipe in 2,500-ft. lots, $54 to $55; ¾-in., $69 to $71, and 1-in., $99 to $101 per 1,000 ft. The same discount applies to galvanized pipe, which for the same sizes was quoted at $59 to $62, $76 to $81 and $110 to $116. Demand continues steady with few orders for large quantities. Jobbers' stocks are good.

Flexible Armored Conductor.—Jobbers generally have advanced their prices on this material about $2 per 1,000 ft. No. 14, two-wire, single-strip, which was quoted last week at $43, has been increased to $45 per 1,000 ft. There has been an active demand for this material for the past month. Much buying has been done in anticipation of the increase as well as for current requirements. Jobbers' stocks are rather spotty and one leading manufacturer is said to be 2,000,000 ft. short of the orders on hand.

Outlet Boxes.—An additional reduction of about 10 per cent in the price of outlet boxes has been announced. Black boxes in standard package lots are quoted at 64 per cent off list and galvanized boxes in the same quantity at 59 per cent off list. Previous discounts were 57 and 53 per cent.

Metal Molding.—Price on the three-wire size remains unchanged at $5.60 per 100 ft. as previously quoted. Demand is light and orders are for small quantities.

Loom.—Jobbers' stocks are kept low to meet the limited demand of this territory. Prices are unchanged. In 1,000-ft. lots the 7/32-in. size sells for $19.25 and the ¼-in. size for $21 per 1,000 ft.

Heating Appliances.—Heating appliances are moving better than for some months past. Jobbers, however, report that their sales are not up to former years. This they attribute partially to stocks remaining in dealers' hands.

Air Heaters.—There continues to be an active demand for heaters, and in view of the moderate demand for other appliances jobbers seem well satisfied with sales thus far.

CHICAGO

With copper prices remaining on the same level as last week, jobbers report fair sales on weatherproof and rubber-covered wire. Other lines have been a little quiet, owing to the possibility of a railroad strike. The threat of a general railroad strike seems to worry most jobbers very little. Some dealers, however, fear that a serious shortage of materials would occur if a strike should be called. Several dealers interviewed expressed the feeling that activity in the electrical industry will keep up throughout the fall and winter in view of the fair start it has received.

Although there are plenty of plans for construction in the city, they have been delayed by one thing or another, but chiefly by the labor disagreement. Although the labor situation is still subject to argument and delay, a tone of improvement has been noticed following the acceptance of the Landis decision this week by several unions.

Wire.—The market has not changed much since last week. The bare-wire base is still at 16 cents. Sales of No. 14 rubber-covered are reported steady at prices ranging from $6.50 to $6.75 per 1,000 ft., in 5,000-ft. lots. In lots of 1,000 ft. or less it sells for $7. Weatherproof is moving moderately on a base of 16 cents.

Flexible Armored Conductor.—The activity of this material continues to be fair, with jobbers reporting prices for No. 14 two-wire, double-strip, at $50 per 1,000 ft. in 5,000-ft. lots. Stocks are on approximately a thirty-day basis.

Schedule Material.—This material is moving well and no price reductions have occurred. Key sockets are quoted at $18.15 per 100 in 500-box lots. Pull sockets sell for $33 per 100 in 500-box lots.

Lighting Fixtures.—One large Middle Western public utility, in a part of its territory including mining, industrial and agricultural load, reports its connect orders not yet filled to be three times normal. This is due in some degree to orders being allowed to pile up, but to a large degree to activity in the building industry, principally residence construction. Jobbers interviewed stated that their orders for residential lighting fixtures were excellent and they are in good condition to fill all orders.

Fuse Plugs.—Movement of this line is fair, and jobbers have sufficient stock on hand to supply the trade. A representative price is $27.50 per 1,000 plugs in lots of 1,000 for fuses up to 30 amp.

High Tension Equipment.—Activity in indoor disconnecting switches has induced one manufacturer to increase his working time from eight hours per day to nine hours. Another manufacturer reports a sale of high-tension equipment for two 1,000-kw. outdoor substations in the West Virginia coal-mine district.

BOSTON

Continued improvement of business is reported by distributers, marked by uneven buying and scattered absorption of products. Little fear of a transportation tie-up was evident locally early in the week, and jobbers were not increasing their purchases on this account. Boston houses are well situated to receive material by water and by motor truck in case of a rail strike, but confidence in well-maintained railroad service is strong in this section. Building and engineering contracts for the week ended Oct. 18 totaled $7,902,000, against $5,800,000 for the corresponding week last year. This is the best week's total for this period in the past twenty years, according to the Dodge tabular summaries. Paper, textile and leather industries are gaining business in New England, and it is reported that the clothing manufacturers have won a complete victory for the open-shop principle, after several months of radical labor strikes. Some shoe factories in this section are sold up to early spring. A little buying for the Christmas trade is evident in jobbing circles, a few dealers having begun to stock up.

Motors.—Further improvement in inquiries is noted and buying is a little better among the smaller sizes. Stocks are ample and prices steady. Textile mill buying is relatively active.

Wire.—Rubber-covered No. 14 is selling at $6.25 per 1,000 ft. in 5,000-ft. lots with fair demand and good stocks. Weatherproof base is 16 cents, with light demand. Central-station construction is dull, and many companies appear to have failed to take advantage of the wire market, which jobbers declare has been unusually favorable to purchasers this fall.

Appliances.—Washing machines and electric ironing machines are moving slowly this week, but table devices are selling more briskly. Electric radiator sales have required moderate purchasing from manufacturers, some jobbing stocks having run pretty low. Toasters and irons are selling with the usual staple demand and stocks are easily meeting current requirements.

Flexible Armored Conductor.—This material is relatively active compared with loom and rigid conduit. No. 14 in 5,000-ft. lots sells around $44.68 to $45 with some shading under sharp competition. No difficulty is noted in meeting current needs.

Sockets.—Trade is a little more active and prices are unchanged, but some comment is heard to the effect that fluctuations may appear. Pulls in case lots sell for 31½ cents net. Increased building activities are absorbing this class of material.

Lamp Cord.—Prices have advanced about 7½ per cent this week, owing to the increased cost of cotton. On No. 18 cotton-covered cord, type C, a price of $1.45 per 100 ft. is quoted in 1,000-ft. lots, $1.75 per 100 ft. in coil lots and $2.20 per 100 ft. in less-than-coil lots. Prices are open on 5,000-ft. lots. Discounts on portable cord range from 35 to 55 per cent according to quantity, and on silk cord they are from 40 to 55 per cent off list.

Outlet Boxes.—A reduction of about 5 per cent went into effect this week. On stamped steel boxes and covers discounts range from 40 to 60 per cent from below $10 list to $250 list, the corresponding discounts on galvanized boxes ranging from 35 to 55 per cent. On gang boxes and switch boxes 30 per cent off is quoted on less than 100, black, and 25 per cent on galvanized; on 100 or over, 40 and 35 per cent respectively with demand light. Steady prices prevail on rigid conduit.

ATLANTA

Reports from mercantile establishments throughout the section indicate considerably increased activity, though little or no credit is being extended. Collection reports seem somewhat contradictory, some sections reporting a considerable improvement while others state that money realized from crop sales is being closely held by the producers, who are paying cash for purchases but not liquidating old accounts. Apparently this is caused by the fear that after liquidation new credits cannot be obtained. Taken as a whole, however, the financial condition throughout the section is very much improved.

Electrical jobbers report their business continuing to hold the increase registered in the month of September, while socket appliances and house-wiring devices show even greater activity, this being the reflection from the large number of residences and small stores under construction. Jobbers are beginning to accumulate their goods for holiday trade on the basis that there will be approximately 75 per cent of last year's business in the portable line and 80 per cent in the toy line. Orders on manufacturers for toys, however, will be only 50 per cent of last year as jobbers had heavy carry-overs in this specialty. Retailers are not yet placing orders for Christmas requirements,

The possibility of the general railroad strike is subject for much discussion, but as yet no heavy preparations are being made to meet the situation.

Radio Outfits.—Considerable interest is being displayed both in and out of the cities in the smaller types of radio apparatus, with the result that sales have shown a very satisfactory increase and prospects are bright for a sustained activity. Local stocks for normal requirements are in good shape.

Flexible Non-Metallic Conduit.—There has been no reduction in price since the cut of 10 per cent two weeks ago. Retailers are placing quite satisfactory orders, and this has served to somewhat deplete local jobbers' stocks.

Lock Nuts and Bushings.—The market in this line is quite active, the sales keeping pace with the movement of armored conductor and rigid conduit. Local stocks are in very fair shape, though prices are somewhat unsteady. One of the largest jobbers reports his stock depleted and a large order was made on a manufacturer this week.

Fuses.—There is the normal fall increase in the demand for fuses, industrial plants placing quite satisfactory orders for the renewable type, while orders by central stations and municipalities for plug fuses are very steady. No recent price changes are reported.

Schedule Material.—The movement of this line has been well sustained for several weeks, with key sockets, rosettes, knobs and tubes leading in popularity. Items throughout the entire line are on hand in sufficient quantities to meet current demands.

ST. LOUIS

Though the railroad strike seems imminent, jobbers here are not inclined to stock up in expectation of slow deliveries, for it is felt that movement to dealers would be equally slow.

Some betterment in the demand for electrical goods was in evidence last week. Several items are finding good call, principally heating appliances, stocks of which are low. The utilities are doing a fair amount of buying and the railroads showed some improvement last week, but the industrial demand remains comparatively dull. Dealers and contractors are in general buying very conservatively and maintaining stocks at a minimum. However, in those items that are priced abnormally low, such as wire and porcelain, there is a tendency to buy considerably in excess of immediate requirements.

Electrical jobbers are getting their share of the obtainable business. Net profits are somewhat better than a few months ago because of the more stabilized prices. A representative jobber says that if the volume of business should increase by 20 per cent, his business would be yielding a good profit, one which could be considered as normal.

Wire.—Prices are holding steadily, No. 14 rubber-covered selling for $6.50 per 1,000 ft. in 5,000-ft. lots and for $6.40 in lots of 10,000 ft. or more. The base on bare and weatherproof varies from 15½ cents to 16 cents per pound. Stocks on the smaller sizes of rubber-covered are low, interchange among the jobbers being required to meet the call. Weatherproof continues to sell in better quantities. There is a marked tendency to buy in excess of immediate requirements because of the present favorable market.

Porcelain.—Strong demand and low stocks prevail. Con-

tractors and dealers are building up heavier stocks. "Nail-it" knobs are selling for $17.50 per 1,000; 2½-in. tubes for $5.25 per 1,000, 3-in. tubes for $5.75 per 1,000, and two-wire and three-wire unglazed cleats for $13 per 1,000, all prices being for barrel lots.

Dry Cells.—The railroads made rather large purchases last week. The demand from other sources also showed improvement, and as a result stocks in jobbers' hands are becoming somewhat low. The regular cell is priced at 31 cents and the igniter at 32 cents, both in barrel lots.

Heating Appliances.—Definite improvement in demand was felt last week by a number of jobbers. The most active items continue to be air heaters and flatirons, stocks of which are extremely low. Good demand and low supply also prevail for curling irons. A small amount of goods is being ordered for the Christmas trade.

Farm-Lighting Outfits.—The disposal of the fall crops by the farmers is resulting in a marked increase in sales, the volume being much better than at the same period last year. Special drives are being conducted in Missouri and Illinois.

Meters.—A fair demand continues. Utilities in the South are buying in better quantities than they have for some time. The residential lighting type is virtually the only one in demand. Stocks are good.

Transformers.—Utilities are still buying good quantities of the distribution type, principally to take care of the new residential lighting business. The construction of dwellings throughout the entire territory is progressing well, and indications are that transformers to serve them will be in good demand for several months. Stocks are in satisfactory shape.

SAN FRANCISCO

Export business is somewhat better as evidenced by the increase in the number of orders and inquiries. The consolidation of firms with parallel organizations and territories will also produce better conditions, and this has occurred in several lines already. During the period from Nov. 19 to Dec. 10 a large industrial exposition will be held in San Francisco showing the development and prospects of the industries of that city and the surrounding territory. This exposition is a part of the Rastall program of industrial exploitation. The Electrical Development League has arranged to take forty out of the 250 booths available.

The threatened railroad strike seems to be decidedly unpopular among the rank and file of Pacific Coast employees. However, the railroads are preparing to meet the emergency, although the strike is generally regarded as unlikely. Shippers, too, are preparing for the prospective shortage, should the strike develop, by wiring in emergency orders to be shipped by short rail haul to a seaport, whence they will come by boat to San Francisco.

Washers.—Decreases coupled with small initial payments have resulted in a good movement. It may be said, however, that generally poor results are attained by special price campaigns and that consistent selling and conscientious demonstration are attracting the public as much as price campaigns.

Heating Appliances.—Local stocks are good. The holiday orders placed by jobbers are comparatively light. In fact, this field is markedly quiet, with little evidence of last year's enthusiasm. It will be remembered that the last holidays promised very well up to December 1 and then dropped off. It was felt that the retail solicitation of the public was begun too soon, and this year the same mistake will not be made.

Fuses.—Jobbers' stocks are well maintained in fairly even quantities, although the stock maximums have been reduced about 25 per cent from the figures of last year. Dealers' orders are usually placed so as to secure the standard-package price for full cartons of designated sizes, and their buying of the larger sizes is distinctly of a hand-to-mouth character. The present prices on new code standard fuses up to 30-amp. size, 250-volt, average about 12 cents each in cartons and 11 cents each in packages.

SALT LAKE CITY—DENVER

Money realized from recent sales of grain and lambs, two staples of the Intermountain Region, has brought considerable relief, enabling country banks to liquidate to a moderate degree. The sugar industry has been granted a new lease of life with promise of permanent stabilization, by a grant of $10,000,000 in loans to producing companies. This comes as a timely relief as there have been rumors that beet growers could not expect immediate cash payment on delivery of the season's crop. Announcement of the loan is good news to all concerned about Western industry.

The unusual spell of open weather seems to have come to an end, and builders predict the slowing up of construction work, with a corresponding falling off in demand for lumber, hardware and electrical wiring materials. The employment situation is a long way from solution, but there are no disturbing labor troubles.

With the coming into circulation of money realized from crops, electrical merchants are intensifying their selling efforts. Many are reviving their advertising after a lapse of months, and some effective campaigns are already launched with particular emphasis on hollow ware, grills and toasters.

Schedule Materials.—Manufacturers have announced reductions that range from 30 to 50 per cent. Jobbers have passed on the advantage of the new rate to their dealers in the hope that lowered costs will stimulate building.

Conduit.—Jobbers' stocks are heavier than the general conditions and volume of business warrant. Price quotations are lower than they have been for years.

Wire.—There is only moderate activity in wire, the demand being at a rather low ebb. The recent small reduction has had no particular effect on the market.

Pole-Line Hardware.—There is no new construction under way and little repair work. Business in pole-line hardware is almost at a standstill.

SEATTLE—PORTLAND—SPOKANE

Announcement has just been made that lumber rates to Eastern markets have been reduced so that Northwest shippers can now compete in Eastern markets with Southern lumber interests. This, together with the big building program now on and the heavy export business, will mean a speedy recovery to normal of the lumber business of the Northwest, one of the primary industries of this region. Wheat exports continue in large volume, and a cargo of 80,000 boxes of apples is being loaded for shipment to Europe.

Jobbers report business continuing good, owing primarily to the large amount of building and the usual fall improvement. It is reported that large buyers are apparently covering themselves in some lines against the announced railroad strike. It is not anticipated, however, that the strike will have any very serious effect as most shipments are now coming by water through the canal. Some jobbers have already diverted shipments to water while others are making plans to have shipments come by water in case of a tie-up. This covering action has caused some stocks to become somewhat short, but shipments are on the way and due to arrive before Oct. 30, both to replenish these stocks and to handle satisfactorily a two months' ordinary business. The temporary shortage on No. 14 rubber-covered wire, due partly to heavy buying on account of the low price of wire before the last increase, has been overcome.

Reports from contractors indicate that not much large contracting business is in sight, and a depressed condition for this line of work will probably exist throughout the winter. Contracting in small work ranging from $500 and under seems to be good, though the prices at which it is taken are very close. Fixtures are very active.

Jobbers quote the following prices: No. 14 rubber-covered wire, $7 and No. 12, $9.20 per 1,000 ft. in 5,000 ft. lots. Black conduit is quoted at $7.50 for ½-in., $9.80 for ¾-in. and $14.10 for 1-in. in 10,000-ft. lots. Quotations for galvanized are $8 for ½-in., $10.45 for ¾-in. and $15.15 for 1-in.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

Washing Machine Reversing Clutch Patent Upheld

A decision in the case of the Conlon Electric Washer Company, Inc., Cicero, Ill., against the Brokaw-Eden Company (now Gillespie-Eden Corporation) has been handed down in the United States District Court, at Springfield, Ill., sustaining the plaintiff and declaring its patent infringed. The Conlon company, manufacturer of Western Electric washing machines, had brought suit against the Brokaw-Eden Company on the ground that it had infringed a patent on a "combination of rotary driving and driven members and intermediate driving connections, including a positively acting motion-reversing clutch and a frictional connection, the latter serving to permit slippage and thus prevent shocks due to the reversal of the action of such clutch and the resulting-reversal of the direction of rotation of said driven member." The application of the patent depended on the use of the frictional clutch, which had been designed to protect washing machines of the oscillating type.

The patent, known as the Neswold patent, was purchased by the Conlon company. The Brokaw-Eden Company pleaded prior art and cited prior patents on methods of permitting slippage in the drive of various other oscillating machinery.

It was held by the court, however, that "Neswold's conception eliminated the belt-driven machine for the operation of a rotating drum and gave to the art a combination of old elements, producing a new result, through a direct-connected unit."

This case has been followed with a good deal of interest by the washing machine industry as it involved a tested principle of oscillating machine practice. No announcement has been made by either party to the suit in regard to further procedure.

Quigley Fuel Department Taken Over by Hardinge Company

The Quigley Furnace Specialties Company, 26 Cortlandt Street, New York City, has announced the sale of its pulverized-fuel department to the Hardinge Company, 120 Broadway, New York. The transfer, it is stated, will in no way affect the refractory specialties business of the Quigley company, which manufactures high temperature cement and insulating refractory brick. According to the announcement, the Hardinge Company will make no change in the method of conducting the business at its offices, as the personnel of the Quigley company's engineering department has been taken over practically intact. According to officials of the Quigley company, the sale was made necessary by the rapid growth of the refractory specialty business, making it advisable for the organization to devote its entire attention to that branch of the work.

Automatic Electric Heater Increasing Distribution

Warren F. Clark, general manager of the Automatic Electric Heater Company, Warren, Pa., is making a trip to the Pacific Coast for the purpose of establishing a factory branch to handle Sepco electric water-heater business in Western territory. The business of the company is developing rapidly, authority having been given at a recent directors' meeting for the erection of another building adjoining the main factory to be used for material storage and increased shipping facilities.

Kellogg Company Completing New Jersey City Plant

The M. W. Kellogg Company, with headquarters at 90 West Street, New York, manufacturer of pipe, fittings and power equipment, has moved into a section of its new plant in the Droyer's Point section of Jersey City and will have the remainder of the plant completed and in operation by early spring, according to the announcement of L. H. Harbison, vice-president. The construction of a three-story building for offices is being planned to start in the very near future.

Another Plant for Witherbee Storage Battery

Plans have been matured by the Witherbee Storage Battery Company, manufacturer of storage batteries, 649 West Forty-third Street, New York, for the closing of its plant at North Bergen, N. J., and the concentration of its manufacturing in New York. In preparation for this move the company has purchased the property of the United Filters Corporation at 355-73 Cortlandt Street, New York. The property consists of a two-story factory and a number of one-story buildings on a site 200 ft. x 150 ft. A few changes will be made in the plant, and production will start as soon as equipment can be transferred from the old to the new location.

Plan Better Lighting Week for Fixture Convention

In preparation for the joint convention of the National Council of Lighting Fixture Manufacturers, the Lighting Fixture Dealers' Society of America and the illuminating Glassware Guild to be held in Milwaukee Jan. 30 to Feb. 4, a committee composed of representatives of all branches of the industry in that city is drawing up plans for a "better lighting week" to draw the favorable attention of the public to the industry. F. A. Coffin, chairman of the "better lighting week" committee, is new-business manager of the Milwaukee Electric Railway & Light Company. Others on the committee are F. A. Raatz, Cutler-Hammer Manufacturing Company; H. Trester, Electrical Association of Milwaukee; F. A. Vaughn, Engineering Society of Milwaukee; H. C. Hutton and Phil Polacheck, Milwaukee Contractor-Dealers' Association; M. Massino, Retail Dealers' Society, and J. A. Sable, Manufacturers' Council. According to present expectations, the national lighting fixture market will be attended by from 4,000 to 5,000 members of the three societies interested.

Association Formed to Study Industrial Friction Drive

A new professional association, the Friction Drive and Engineering Society, organized for the purpose of making a study of questions involved in design of successful friction drives, will hold its second meeting at the plant of the Rockwood Manufacturing Company, Indianapolis, on Nov. 3. The society was formed at an initial meeting at Newark, N. J., held Sept. 20. The following temporary officers were elected: C. A. S. Howlett, Divine Brothers, Utica, N. Y., president; W. D. Hamerstadt, Rockwood Manufacturing Company, vice-president, and C. W. Kelsey, secretary and treasurer.

The society will attempt to further the use of friction drives by studying methods of improving the materials and mountings and by compiling complete engineering data, and, in general, will endeavor to aid any manufacturer using the drive.

At the meeting to be held on Nov. 3 the permanent organization will be completed. There will be two papers presented, one covering the "History of Friction Drives and Friction Materials," by W. D. Hamerstadt, and the other on "A New Form of Friction Wheel," by C. A. S. Howlett.

New Appliance Association Formed

Announcement has been made of the organization of the Electrical Appliance Distributers' Association, the charter members of which are among the large household appliance dealers of New York City. The prime purposes of the association are to further the interest of the entire appliance industry, to

maintain relations with manufacturers and jobbers, to educate salesmen and to see that in contact with the public high standards are maintained. It has also been suggested that the association establish a yearly appliance show.

A number of ways were suggested in which dealers could help manufacturers and jobbers, among which was assistance in getting out the proper sort of advertising to appeal to the public in certain territories. At the present time the constitution of the society is so worded that manufacturers and jobbers may not hold membership in the association, but a proposal has been made that the constitution be amended to permit them to hold associate membership.

Officers elected at the first meeting were: James McClymont, Laun-Dry-Ette Sales Company, president; Samuel Kimball, Kimball Electric Company, vice-president; J. N. Adam, Hoover Suction Sweeper Company, treasurer, and I. Bailey, Eureka Vacuum Cleaner Company, secretary.

Meetings of the association will be held on the first Wednesday of each month.

General Electric Jobbers May Merge

Efforts are being made, it is reported, to establish a basis upon which to merge three New York distributers and one Newark distributor of the General Electric Company. The merger, if completed, will include E. B. Latham & Company, Royal Eastern Supply Company, Sibley-Pitman Electric Corporation, all of New York, and the Tri-City Electric Company, Newark, N. J. The name of the company has not been decided upon, but from application made for registration it would indicate that the consolidation will ultimately bear a name symbolic of its sales market along the Atlantic Seaboard.

The merger would represent a very high capital investment. The lamp distribution controlled by the company averages approximately $4,000,000 a year. According to officials of the interested companies, the consolidation will not take place before the end of the year or may be postponed indefinitely, provided it is found impossible to reach a basis satisfactory to all concerned.

Foreign Trade Notes

ELECTRIC SYSTEM FOR POLISH PETROLEUM BASIN.—A group of petroleum companies at Boryslav, according to the *Journée Industrielle*, is planning to construct a large electric power station to supply electricity for boring of soundings and operating pumps. The Minister of Industry and Commerce has promised the co-operation of his department for the purpose of creating an electric system for the whole of the basin.

PROPOSED HYDRO-ELECTRIC DEVELOPMENT IN INDIA.—Tata Sons & Company, according to *Electrical Industries*, have obtained a license for the proposed Nilgiri (British India) hydro-electric project.

PROPOSED NEW ELECTRIC PROJECT IN JAPAN.—Applications have been made to the Department of Communication of Japan by nine electric companies, according to the *Japan Chronicle*, for permission to utilize the waters of the Tenryu River, which flows into the bay of Totomi through Nagono and Shizuoka Provinces. It has been decided that the applicants should amalgamate with a capitalization of 50,000,000 yen (about $25,000,000). Petitions so far received will develop 200,000 kw. in all.

PROPOSED ELECTRIC RAILWAY PROJECT IN INDIA.—A large supply of electrical energy will be required, according to *Electrical Industries*, in connection with the proposed electrification of the suburban lines of the G. I. P. To insure the supply of electricity it is proposed to interconnect the Andhra Valley, the Tata power and the hydro-electric companies. It will require nearly 17,000,000 units per annum to operate the railway from V. Telminus, to Kurla; when extended to Thana, 29,000,000 units, and when extended to Kalyan, 36,000,000 units.

EXTENSION OF USE OF ELECTRICITY IN COLLIERIES IN SOUTH WALES. A scheme to extend the use of electricity in its collieries, according to *Electrical Industries*, is now being carried out by the Powell Duffryn Coal Company, South Wales, the cost of which is estimated at more than £1,000,000. The power house at Bargoed when completed will have a generating capacity of about 30,000 kw. The transmission line, which will be about 15 miles long, will supply electricity for lamps and motors to all the collieries in the Rhymney, Aberdare and Deri Valleys and at Llantrisant. The chief object of the plan is to effect economy in the working of the collieries and also to substitute electricity for steam power.

TO REGULATE THE USE OF ELECTRICITY IN MINES OF BELGIUM.—A permanent advisory committee of nine members to deal with the applications of electricity to mines and the regulations governing the use of electricity, etc., has been appointed by the Belgian Mines Department. Among the members of the committee are M. Lebacqz, director-general of mines, Brussels; Prof. O. De Bast, Liege, and M. Wattiez, electrical engineer, Charleroi.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

A mercantile firm in Sweden (No. 177) desires to purchase or secure an agency for the sale of X-ray and electric lamps.

MATERIAL FOR CITY OF AUCKLAND ELECTRICITY SCHEME.—The city engineer of Auckland, New Zealand, according to *Electrical Industries*, estimates the cost of material for the electricity scheme during the next two years as follows: Meters, £10,000; 60 miles of distributing lines, £30,000; substation and feeder extensions and switchgear, £26,000.

EQUIPMENT FOR ELECTRIC TRAMWAYS, NEWCASTLE, AUSTRALIA. — A preliminary installment of £120,000, according to *Electrical Industries*, is being put on the estimates for the next financial year by the city of Newcastle, New South Wales, Australia, to provide for contract for plant and material required in connection with the proposal to electrify the tramway system.

EXTENSIONS TO TRAMWAY SYSTEM IN AUCKLAND, NEW ZEALAND.—The City Council, according to *Electrical Industries*, has authorized extensions to the tramway system in the suburbs involving an expenditure of £82,000. Seven new cars will be required.

LONG-DISTANCE TELEPHONE SERVICE IN COLOMBIA.—The establishment of a long distance interurban telephone service to be operated in connection with the telegraph system, which is owned by the government, according to *Electrical Industries* is under consideration by the government of Colombia, South America. The proposed work is to be carried on under the supervision of the Director-General de Telegrafos, Bogota, from whom any further information which is desired may be obtained.

IMPROVEMENTS TO ELECTRIC AND TELEPHONE SERVICE IN BARRETOS AND OLYMPIA, BRAZIL.—The Empresa Orion de Barretos Electric Light Company, with headquarters in Sao Paulo, Brazil, is advertising a public loan of 2,000,000 milreis, the proceeds to be used for improvements to the electric power and telephone service in the municipal districts of Barretos and Olympia, State of Sao Paulo.

New Apparatus and Publications

SAFETY SWITCH—The United Metal Box Company, 514 West Forty-sixth Street, New York City, has recently placed on the market an externally operated safety switch.

BURGLAR ALARM CLOCK—The Midnight Alarm System, 6411 Mack Avenue, Detroit, has recently developed a control switch and lock for burglar alarm installations.

WIRELESS APPARATUS—A crystal detector radio receiving station "A B C", has recently been placed on the market by the Jewett Manufacturing Corporation, 32 Austin Street, Newark, N. J.

OUTLET BOX—A new type of outlet box, made in two sizes, one for concrete setting and the other for brackets, receptacles, switches and extension rings has been developed by the J. G. Knight Company, 1034 Dean Street, Brooklyn, N. Y.

LAMP SOCKET—A socket designed to maintain constant contact has been brought out by the Diamond Electric Specialties Corporation, 101 South Orange Avenue, Newark, N. J.

BENDER—A bender to use with its "Wiremold" conduit has recently been developed by the American Wiremold Company, Hartford, Conn.

CHRISTMAS TREE OUTFIT—The United States Electric Manufacturing Corporation, 476 Broadway, New York City, has recently placed on the market a Christmas tree lighting outfit.

IRONING MACHINE—The Quaker Manufacturing Company, 140 North Dearborn Street, Chicago, has placed on the market an electric ironing machine.

VACUUM CLEANER—The Wisconsin Electric Company, Inc., Racine, Wis., has placed on the market a vacuum cleaner ("Dumore") designed primarily for cleaning upholstery of closed cars.

SIGN LAMPS—A sign lamp which operates without a filament has been placed on the market by the Neon Lamp Works, Inc., 62-70 West Fourteenth Street, New York City.

ELECTRIC HEATER AND TOASTER — L. Plaut & Company, 432 East Twenty-third Street, New York City, have developed a "Double Ray" combined electric heater and toaster.

New Companies

THE PHILLIPSTOWN (N. Y.) ELECTRIC CORPORATION has been chartered to operate a local electric light and power plant. H. C. Derham and W. M. Benjamin, Phillipstown, are interested.

THE DALITE LAMP COMPANY OF NEW JERSEY, Jersey City, N. J., has been organized by A. Carrell and Warren Dixon, 665 Newark Avenue, to manufacture electric lamps. The company is capitalized at $50,000.

THE MOOREHEAD ELECTRIC MACHINERY COMPANY, Pittsburgh, Pa., has been incorporated to manufacture electrical machinery and parts. I. R. Moorehead 3417 Kedzie Avenue, is treasurer.

THE OHIO GENERATING COMPANY, Red Lion, Pa., has been organized to manufacture farm lighting plants and systems. The directors of the company are C. S. LaMotte, president; and Charles C. Meads secretary, both of Red Lion.

THE RAY BATTERY COMPANY, Detroit, Mich., has been chartered under the laws of the State of Delaware by Joseph S. McDowell and M. J. Holliday, Detroit. The company is capitalized at $1,000,000 and proposes to manufacture electric batteries and other electrical products. The Corporation Trust Company of Delaware, Equitable Building, Wilmington, Del., represents the company.

Record of Electrical Patents

Notes on United States Patents

(Issued Sept. 20, 1921)

1,390,907. AUTOMATIC CALL SYSTEM FOR HOTELS; Albert H. Heyroth, Duluth, Minn. App. filed Jan. 19, 1921. Master clock in combination with an annunciator cabinet.

1,390,921. LOOM PLATE AND HANGER; Adolph Olevin, Detroit, Mich. App. filed Jan. 28, 1921. Suspended from a cleat hanger or overhead track.

(Issued Sept. 27, 1921)

1,391,794. SUSPENSION APPARATUS; Norman F. Rutherford, East Falmouth, Mass. App. filed May 16, 1919. For suspending a power transmission line.

1,391,808. SYSTEM OF MOTOR CONTROL; Hermon L. Van Valkenburg, Milwaukee, Wis. App. filed April 14, 1920. Compensator starting switch.

1,391,831. ELECTRIC LANTERN; Louis A. Hornburg, Omaha, Neb. App. filed March 25, 1921. For use as railway signal and switch light.

1,391,855. WIRELESS TRANSMITTING SYSTEM; Henry K. Sandell, Chicago, Ill. App. filed Nov. 28, 1919. By undamped or continuous waves.

1,391,868. LOCKING DEVICE FOR INCANDESCENT LAMPS; Leon M. Topoosian, Springfield, Mass. App. filed Aug. 9, 1919. For preventing removal of lamp from socket.

1,391,903. TROLLEY-WHEEL FOR ELECTRIC STREET CARS; Julio S. Navarro, Havana, Cuba. App. filed April 9, 1921. Made in three or more separate disks.

1,319,904. CLUSTER LAMP SOCKET; Thomas O'Donnell, Ironwood, Mich. App. filed Nov. 12, 1919. Readily separated and asembled.

1,391,911. GROUND DETECTOR; Ernest J. Simon, Guantanamo, Cuba. App. filed July 8, 1918. Not easily thrown out of adjustment.

1,391,944. RELAY; Frank L. Dodgson, Rochester, N. Y. App. filed March 31, 1917. Arrangement of parts which insulate binding posts from supporting panel.

1,391,960. ELECTRIC HEATER; Richard G. Ledig, Philadelphia, Pa. App. filed Oct. 25, 1920. Reflector type.

1,391,996. CONTROL FOR ELECTRIC FURNACES AND THE LIKE; Edgar F. Collins, Schenectady, N. Y. App. filed Nov. 14, 1918. Predetermined temperature automatically reached and maintained.

1,392,022. DYNAMO-ELECTRIC MACHINE; Charles A. Parsons and Jessel Rosen, Newcastle-upon-Tyne, England. App. filed Feb. 10, 1919. Heating lessened.

1,392,032. ELECTROMAGNETIC BRAKING DEVICE; Clifford A. M. Weber, Edgewood Park, Pa. App. filed Nov. 3, 1916. Quick, positive and readily adjusted.

1,392,038. OUTLET BOX; William H. Wood, Darien, Conn. App. filed Jan. 17, 1920. Applied to walls of buildings already plastered.

1,392,039. DYNAMO-ELECTRIC MACHINE; John L. McK. Yardley, Pittsburgh, Pa. App. filed April 14, 1913. Synchronous-booster rotary converters and means for improving the commutating conditions.

1,392,052. FLASHOVER-SUPPRESSING MEANS FOR ROTARY-CONVERTER SYSTEMS; Frederic C. Hanker, Wilkinsburg, Pa. App. filed June 17, 1918. Simple, effective and inexpensive.

1,392,056. CONTROL SYSTEM; Henry D. James, Edgewood Park, Pa. App. filed May 27, 1918. Motor-accelerating system.

1,392,057. CONTROL SYSTEM; Henry D. James, Edgewood Park, Pa. App. filed Aug. 10, 1918. Reversing system for electric motors.

1,392,058. MOTOR-CONTROL SYSTEM; Henry D. James, Edgewood Park, Pa. App. filed Jan. 8, 1919. Motor-accelerating system.

1,392,059. CONTROL SYSTEM; Henry D. James, Edgewood Park, Pa. App. filed Jan. 8, 1919. Motor-accerlating system.

1,392,060. CONTROL SYSTEM; Henry D. James, Edgewood Park, Pa. App. filed May 12, 1919. Motor-accelerating systems.

1,392,073. END BELL; Emil Mattman, Wilkinsburg, Pa. App. filed April 4, 1916. Turbo-generator.

1,392,076. SYSTEM OF EXCITATION FOR SYNCHRONOUS-BOOSTER ROTARY CONVERTERS; Frank D. Newbury, Pittsburgh, Pa. App. filed Dec. 13, 1917. Proper commutating field supplied throughout wide changes in load.

1,392,084. FIELD-CONTROL SYSTEM FOR SYNCHRONOUS-BOOSTER ROTARY CONVERTERS; Marvin W. Smith, Wilkinsburg, Pa. App. filed Jan. 16, 1919. For controlling interpole-field strength.

1,392,086. MEANS FOR REDUCING COMMUTATOR FLASHING; Norman W. Storer, Pittsburgh, Pa. App. filed Nov. 23, 1917. Simple, inexpensive and highly effective.

1,392,087. MEANS FOR SUPPRESSING FLASHOVERS IN ROTARY-CONVERTER SYSTEMS; Norman W. Storer, Pittsburgh, Pa. App. filed July 25, 1918. For suppressing flashovers in rotary-converter systems.

1,392,088. MEANS FOR REDUCING COMMUTATOR FLASHING IN ROTARY CONVERTERS; Norman W. Storer, Pittsburgh, Pa. App. filed March 13, 1921. To dissipate the energy of the machine in an external circuit.

1,392,091. ELECTRIC FITTING; George B. Thomas, Bridgeport, Conn. App. filed Dec. 4, 1918. Combined electric lamp socket and attachment-plug receptacle.

1,392,135. TYPEWRITING MACHINE; Oskar Fischer, Berlin-Wilmersdorf, Germany. App. filed March 19, 1914. Electrically operated.

1,392,137. CIRCUIT INTERRUPTER; Charles LeG. Fortescue, Pittsburgh, Pa. App. filed Oct. 6, 1916. To reduce the voltage on field-magnet winding when a ground or short circuit occurs.

1,392,152. MULTIPLE-STATION TRANSMISSION CIRCUITS; William H. Harden, New York, N. Y. App. filed Dec. 13, 1918. Service to a number of stations bridged across the line at various points.

1,392,163. ELECTRIC POCKET LAMP; Oscar Hoffmann, Stuttgart, Germany. App. filed Jan. 11, 1921. Battery replaced in easiest possible manner.

1,392,176. DUPLEX LAMP SOCKET; William J. Koenig, Brooklyn, N. Y. App. filed Jan. 20, 1920. Resilient contact carrier.

1,392,179. OPERATOR'S TRUNK CIRCUIT; George W. Kuhn, Brooklyn, N. Y. App. filed Sept. 5, 1918. Trunk circuits leading to special positions.

1,392,182. MEANS FOR PREVENTING COMMUTATOR FLASHING; Benjamin G. Lamme, Pittsburgh, Pa. App. filed June 17, 1918. For minimizing or preventing flashing.

1,392,193. SHORT-CIRCUITING AND BRUSH-LIFTING DEVICE FOR DYNAMO-ELECTRIC MACHINES; Chester B. Mills, East McKeesport, Pa. App. filed April 9, 1918. For use with rings of induction motors of wound-rotor type.

1,392,198. PROTECTIVE APPARATUS FOR DYNAMO-ELECTRIC MACHINES; Charles McL. Moss, Pittsburgh, Pa. App. filed June 29, 1918. Means for reducing commutator flashing.

1,392,199. ELECTRIC MEASURING INSTRUMENT; Alfredo Muratori, Rome, Italy. App. filed Dec. 9, 1916. For use on systems where consumer is charged under a differential tariff.

1,392,232. SECONDARY OR STORAGE BATTERY; Edward W. Smith, Philadelphia, Pa. App. filed Sept. 4, 1915. Wood separator.

1,392,234. PIVOTAL MOUNTING; Allen A. Tirrill, Pittsburgh, Pa. App. filed Aug. 11, 1917. For vibratory members such as armatures of electrical relays.

1,392,250. CONTROL SYSTEM; Ray E. De Camp, Wilkinsburg, Pa. App. filed Aug. 26, 1918. Motor starting.

1,392,252. SYSTEM OF ELECTRICAL DISTRIBUTION; James K. Delano, New York, N. Y. App. filed July 21, 1920. To storage-battery-charging systems.

1,392,255. MOTOR-CONTROL SYSTEM; Edwin S. Lammers, Jr., Wilkinsburg, Pa. App. filed June 13, 1917. Operation of series of electromagnetic switches in predetermined sequence.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

LOWELL, MASS.—The Boott Manufacturing Company, it is reported, has applied to the Department of Public Works for authority to build a hydro-electric power plant on the Merrimack River.

PAWTUCKET, R. I.—The Board of Education contemplates the construction of a new manual training and industrial arts school on Fountain Street, to cost more than $1,000,000. Electrical equipment, machine tools and other apparatus will be required.

MIDDLETOWN, CONN.—The Portland Silk Company is considering the construction of a one-story power house at its plant.

Middle Atlantic States

JORDAN, N. Y.—The Jordan Electric Light & Power Company has applied to the Public Service Commission for approval of charters to operate in parts of the towns of Elbridge and Van Buren not at present supplied with electricity.

POUGHKEEPSIE, N. Y.—The Central Hudson Gas & Electric Company is asking for bids on an 8½ mile, 66,000 volt., single-circuit, two-conductor transmission line.

UTICA, N. Y.—Bids will be asked soon by the State Hospital Commission, Capitol Building, Albany, for the construction of a two-story cold storage plant, 70 ft. x 110 ft., at the Marcy Division State Hospital, Utica, to cost about $130,000. L. F. Pilcher, Capitol Building, is state architect.

ASBURY PARK, N. J.—Plans are under way by the Richelieu Corporation, 649 Mattison Avenue, for the construction of a plant on Asbury Avenue, for the manufacture of automobiles and parts. The initial unit will include a one-story and two-story building, 80 ft. x 200 ft., with power plant, to cost about $200,000 with machinery. Samuel A. Reeves is president.

LONG BRANCH, N. J.—The Board of Commissioners have authorized the installation of a new lighting system on parts of North Lincoln, Second, Third and Atlantic Avenues, Elberon Square and part of Ocean Park grounds.

TRENTON, N. J.—The Trenton & Mercer County Traction Corporation contemplates the installation of an underground conduit system on Lincoln Avenue, to cost about $25,000. Rankin Johnson is president.

BEAVER FALLS, PA.—Plans are under consideration for the installation of an ornamental lighting system on Seventh Avenue from Fourth to Seventeenth Street. Electrical service is supplied by the Beaver County Light Company, New Brighton.

FOXBURG, PA.—Surveys are under way by the Clarion River Power Company, Foxburg, for the construction of a hydro-electric generating plant on the Clarion River near Foxburg, to cost over $2,000,000. The work is being financed by H. D. Walbridge & Company, 14 Wall Street New York City, who will supervise the preparation of plans

JOHNSTOWN, PA.—Arrangements have been made by the Penn Public Service Corporation for an issue of $1,082,000 in bonds, the proceeds to be used for extensions and improvements to its electric power plants and system.

OXFORD, PA.—The Penn-Oxford Electric Company and the New London Electric Company have been organized by J. H. Ware, Jr., and associates, to operate electric light and power plants in this section.

PHILADELPHIA, PA.—Horace T. Potts & Company, 316 North Third Street, manufacturers of iron and steel products, will start work at once, it is understood, on the construction of a new plant, at D Street and Erie Avenue, including main iron-working plant, power house, foundry, etc. The cost is estimated at $450,000.

PHILADELPHIA, PA.—Plans have been prepared by the Consolidated Ice Company,

2331 Bodine Street, for the construction of a one-story power house.

PITTSBURGH, PA.—Plans have been prepared by the Duquesne Light Company, Pittsburgh, for the construction of a one-story power house in Mount Lebanon Township to furnish electricity in that district.

READING, PA.—Arrangements have been made by the Metropolitan Edison Company for an issue of $216,500 in bonds and $100,000 in stock, the proceeds to be used for extensions, etc.

SCRANTON, PA.—The Lackawanna Railroad Company, 90 West Street, New York, N. Y., is having estimates of cost prepared in connection with the electrification of its Scranton division. The present plans provide for power plants, electric locomotives and other equipment. Upon completion of the project, electrication of other divisions of the road will be followed, particularly in New Jersey.

SCRANTON, PA.—Bids will be asked soon for the construction of a one-story power house at Mount St. Mary's Convent, 2300 Adams Avenue. John J. Hawley, Traders' Bank Building, is architect.

BUCKAHANNON, W. VA.—The Buckahannon Light & Water Company has filed notice of an increase in capital stock from $25,000 to $50,000.

GRAFTON, W. VA.—The Kentucky & West Virginia Power Company, 30 Church Street, New York City, has acquired the power plant of the Grafton (W. Va.) Power & Electric Company, and contemplates extensions and improvements to the system, including the installation of new equipment. The plant will be operated in conjunction with the generating system at Logan, W. Va., as well as Caddell near Kingwood, W. Va. The cost of the proposed improvements is estimated at $1,500,000. N. M. Argabrite is vice-president and general manager.

MAN, W. VA.—The Man Power & Lighting Company, recently incorporated with a capital stock of $10,000, has applied for a franchise to furnish electricity in the city and vicinity for light and power purposes.

North Central States

DIMONDALE, MICH.—The construction of a municipal electric light plant in Dimondale, to cost about $13,000, is under consideration by the village authorities.

MARLETTE, MICH.—Plans are being prepared by R. L. Blackman for the construction of a new municipal power plant in Marlette. Bids for construction, it is understood, will be asked early in 1922.

WEBBERVILLE, MICH.—Work will be started soon by the Detroit (Mich.) Edison Company on the construction of a substation in Webberville to supply electricity in the towns in this vicinity.

CLEVELAND, OHIO.—The City Council has authorized an expenditure of a sum not to exceed $130,000 for extensions to the municipal electric light and power system.

CLEVELAND, OHIO.—The Council has authorized the extension of the lighting system on West Boulevard from Lorain Avenue south to Linnet Avenue, to cost about $12,500.

CLEVELAND, OHIO.—Resolutions have been alopted by the City Council providing for the installation of an ornamental lighting system in Central Avenue from East Fourteenth to East Fifty-fifth Streets; to install necessary electric lamps on East Eighty-second Street, on West 112th and West 114th Streets, north of Detroit Avenue, and on Ludlow Avenue; and to replace gas lamps with electric lamps on a number of streets.

TOLEDO, OHIO.—The Toledo Railways & Light Comhany has been reorganized under the name of the Toledo Edison Company. Notice has been filed of an increase in capital stock from $15,000,000 to $25,000,000, the proceeds to be used to purchase the plant of the Acme Power Company, and for other extensions and improvements to plants and system.

GEORGETOWN, KY.—At an election to be held in November the proposal to issue $100,000 in bonds for the establishment of electric light and water systems will be submitted to the voters.

SERGENT, KY.—The Commercial Mining Company, Connellsville, Pa., is contemplating the installation of new electrical equipment and other machinery at its coal properties at Sergent, Ky.

VINCENNES, IND.—Plans are under consideration for rebuilding the power house and other buildings at the flour mills of the Atlas Mills Company, recently destroyed by fire. The loss including machinery, is estimated at about $200,000.

BROWNSTOWN, ILL.—The proposal to issue $8,000 in bonds for the erection of a transmission line from Vandalia to Brownstown is under consideration.

PEORIA, ILL.—Arrangements have been made by the Central Illinois Light Company for an issue of $1,053,000 in bonds, the proceeds to be used for extensions and improvements to its plant and system, etc.

SPRINGFIELD, ILL.—Seven subsidiary companies of the Illinois Traction System have filed applications with the Illinois Public Utilities Commission for the right to issue additional stock and bonds as follows: The Bloomington & Normal Railway & Light Company, $69,000 in bonds and $73,000 in stock; Danville Street Railway & Light Company, $84,000 in bonds; Urbana & Champaign Railway, Gas & Electric Company, $3 000 in bonds;; Madison County Light & Power Company of Edwardsville, $69,000 in bonds; Galesburg Railway, Lighting & Power Company, $700,000 in bonds.

ADRIAN, MINN.—Plans have been prepared for the construction of a municipal electric light and power plant, to cost about $40,000. M. J. Farrager is clerk.

MINNEAPOLIS, MINN.—The installation of a new system of lighting in the city parks and parkways, providing for the elimination of arc lamps, is under consideration by the park officials. The plan as tentatively proposed is that the Park Board should provide the lighting fixtures and purchase electricity from the Minneapolis General Electric Company. A. C. Godward is park engineer.

OSHKOSH, WIS.—The Council has passed an ordinance providing for establishing an ornamental lighting system in Oshkosh.

MILWAUKEE, WIS.—Bids will be received by the Sewerage Commission of the City of Milwaukee, City Hall, until Nov. 11, for furnishing coal and ash handling machinery including track hopper equipment, crusher, elevator, skip hoist, motors and controllers, storage bins, spouts, automatic scales, ash cars and track, and appurtenances complete, for building on Jones Island, Milwaukee. Specifications and blank forms of proposal can be obtained and detailed plans examined at the office of the Sewerage Commission, City Hall.

KANSAS CITY, MO.—The City Ice Company, Twenty-first and Campbell Streets, is considering the construction of a new ice-manufacturing plant, 42 x 80 ft. at Twentieth and Washington Streets, to cost about $75,000.

PLATTE CITY, MO.—Authority has been granted to the Platte City Light & Power Company to purchase electric plants from Henry Gordon and A. C. Morton at Smithville, and from George C. Paris at Weston. The company is planning the erection of an electric transmission line from the plant of the Kansas City Power & Light Company at Fairview to Smithville, Nashua and Platte City including Linkville.

ST. LOUIS, MO.—The St. Louis Lead & Oil Works, International Life Building, contemplates the immediate construction of a power house at its plant at Manchester and Sublette Streets.

Southern States

CHARLOTTE, N. C. — The Southern Power Company is asking for bids on a 66,000-volt transmission line to be erected near Charlotte.

PITTSBORO, N. C.—Negotiations are under way between the Town Commissioners and the Moncure Manufacturing Company whereby the latter would furnish electricity for lighting the town from its plant at Lockville on Deep River now under construction.

ALBANY, GA.—The Georgia-Alabama Power Company has been granted a franchise by the City Council for the erection of a transmission line from its hydro-electric plant in Albany to Cordele.

LOUISVILLE, GA.—The municipal electric light plant was recently damaged by fire.

MOUNT AIRY, GA.—W. G. Martin, Leesburg, and associates, are considering the construction of a hydro-electric generating plant on the Broad River near Mount Airy.

LAKELAND, FLA.—The City Council is contemplating the extension of transmission lines to Lakeland Highlands, a distance of 8 miles, and to Haskell, 7 miles, to furnish electricity for light and power purposes.

MEMPHIS, TENN.—Plans are under way by the Stryker Kot-N-Wood Products Company for the construction of the first unit of a plant, 60 ft. x 200 ft., with power house adjoining for the manufacture of wallboard products. George B. Stryker is president.

GANTT, ALA.—The River Falls (Ala.) Power Company is contemplating the erection of a 2,500-hp. hydro-electric generating plant on the Conecuh River at Gantt. Construction will be undertaken by the company's own forces. The Southern Engineering Corporation is engineer.

LAMBERT, MISS.—Electric light and street bonds to the amount of $30,000 have been voted.

BATESVILLE, ARK.—The City Council is considering improvements to the municipal water and light plant, including the installation of two boilers and other machinery, to cost about $10,000.

LITTLE ROCK, ARK.—Preparations are under way preliminary to survey for the development of a 50,000-hp. project on the Buffalo River, to cost about $6,250,000. Col. Henry A. Allen, 154 West Randolph Street, Chicago, Ill., is engineer.

MARLOW, OKLA.—Plans are being prepared by V. V. Long & Company, engineers, Colcord Building, Oklahoma City, for an addition to the municipal power plant, to cost about $55,000.

CAMERON, TEX.—Bids will be opened in about 90 days, it is reported, for the construction of a 600-hp. municipal plant, to cost about $40,000. James D. Fowler, 606 Sumpter Building, Dallas is engineer.

FORT WORTH, TEX.—Extensions to the lighting system to cost about $50,000, are contemplated. R. A. Hunter is City Commissioner.

PALESTINE, TEX.—The Anderson County Coal Company, Box 68, recently incorporated with a capital of $100,000, is asking for prices, it is understood, on an electrical power plant, hoisting machinery, electric cutters for 1-ton to 1,000-ton daily capacity lignite mine, etc. J. J. Barry is manager.

Pacific and Mountain States

ARLINGTON, WASH.—The Washington Coal Utilities Company is considering extending its transmission lines to Burmingham.

EPHRATA, WASH.—The Soap Lake (Wash.) Utilities Company has applied to the Town Council for a franchise to erect a transmission line from Soap Lake to Ephrata.

OLYMPIA, WASH.—The Gray's Harbor Railway & Light Company, Aberdeen, Wash., has applied to the State Highway Committee, Olympia, for authority to erect a transmission line along the Olympic Highway. James Allen is secretary of the committee.

SEATTLE, WASH.—The Puget Sound Power & Light Company is considering an issue of $1,000,000 in notes, the proceeds to be used for extensions and improvements to its power plants and system.

CANBY, ORE.—M. J. Lee of Canby has been granted a franchise by the City Council to furnish electricity for light and power in Canby and surrounding district, by means of a transmission line to be erected. Electrical energy, it is understood, will be purchased from the Portland Railway, Light & Power Company at Oregon City.

MERCED, CAL.—Bids, it is reported, will be received until Nov. 7 for the installation of an electrolier system in Merced, to cost about $300,000. Plans are filed in the office of W. W. Cornell, city clerk.

RICHFIELD, IDAHO.—Application has been made by the Idaho Power Company, Boise, to the Public Utilities Commission, for permission to erect an 11,000-volt transmission line from Richfield to Shoshone, a distance of about 18 miles. The line will be constructed so as to provide for a maximum of 44,000 volts.

GREAT FALLS, MONT.—The City Council has adopted plans for the installation of a lighting system on First Avenue north from Park Drive West under the Great Northern viaduct to west end of the subway.

GUERNSEY, WYO.—Water users of North Platte Valley have approved the construction of a reservoir dam and power plant at Guernsey, to cost more than $2,000,000.